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ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

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NUCLEAR SCIENCE ABSTRACTS

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Published by the ERDA Technical Information Center

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

The following organizations scan and abstract the nuclear science literature in their respective countries for input to the International Nuclear Information System of the International Atomic Energy Agency. By special agreement, the input to INIS is simultaneously sent to the ERDA Technical Information Center to enhance the timeliness of coverage of that literature in *Nuclear Science Abstracts*.

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Commissie Nucleaire Informatieverzorging (Netherlands)
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Zentralstelle für Atomkernenergie-Dokumentation (West Germany)

Numerous organizations, societies, and publishers throughout the world provide *Nuclear Science Abstracts* with advance page-proof copy of their publications.

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts*. The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

NOTICE

The publication of *Nuclear Science Abstracts* is planned to be discontinued after Vol. 33, No. 12, dated June 30, 1976. *Atomindex*, published by the International Atomic Energy Agency and a product of the International Nuclear Information System (INIS), will provide essentially identical literature coverage, subject scope, abstracting and indexing with that of *NSA*. For all practical purposes the two journals are identical. The Energy Research and Development Administration, formerly the Atomic Energy Commission, has supported the concept and development of INIS for several years. At this time, it is quite apparent that the decentralized scanning, abstracting and indexing on a country-by-country basis is reliable and successful. Consequently, it is no longer necessary for the United States to bear the entire burden of publishing an abstract journal covering the world's nuclear literature. ERDA will continue to provide coverage of U. S. nuclear literature to INIS.

Atomindex is available on a subscription basis from UNIPUB, P. O. Box 433, Murray Hill Station, New York, New York 10016, for $150 per year including cumulative indexes. ($100 per year without cumulative indexes.)

ERDA's new journal, *ERDA Research Abstracts* (*ERA*), will contain abstracts and indexes to all literature of ERDA origin as well as nonnuclear energy information generated by foreign countries with which ERDA has agreements for cooperation. *ERA* is available to government agencies on the same basis as *NSA* and on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information.

The public may obtain *ERA* from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402. The annual subscription rate for the 12 regular issues including an annual cumulative index is $119 for domestic subscribers, and $148.75 for foreign subscribers. Individual issues will be priced at $7.40 domestic, and $9.25 foreign. Separate annual index cumulations will cost $30.50 domestic, and $38.15 foreign.

INDEXES TO *NSA*

Comprehensive indexes appear in each issue and are cumulated at the end of each volume. The report number indexes will be cumulated on both a volume and two-volume basis. Multivolume cumulations have been issued as indicated above.

All documents abstracted are indexed by subjects and personal authors. Report literature is indexed also by corporate author and report number. Each of these indexes in every issue is preceded by an introduction explaining in detail the organization of the index and the principles by which it is compiled. The reader is referred to these explanations for information not found in the brief summaries below.

Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

SOLDAN, D.W., Shipping container for a bottle of radioactive material, 32:20462
SOLDAT, J.K., Dosimetry of the radioactive noble gases, 32:19916 (BNWL-SA-4813)
SOLOMAKHA, D.A., Measurement of the 1.15-μm wavelength of a helium--neon laser, 32:19555

Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

URANIUM ORES/GEOCHEMISTRY
  Change of uranium concentration in plagioclase of various zones of microcline--albite--oligoclase pegmatites of Karelia, 32:19704
URANIUM ORES/LEACHING
  Preparation of uranium compounds (Patent), 32:19329
URANIUM ORES/MINING
  The uranium mining and its importance for the energy supply, 32:19701
URANIUM ORES/ORE PROCESSING
  Supplies for the fuel cycle for Spanish nuclear power plants, 32:19702
URANIUM OXIDES
  See also URANIUM DIOXIDE
  URANIUM OXIDES U3O8

Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

20457 (LA-5954) 100-MHz POWER AMPLIFIER DESIGN AND CONTROL FOR A HEAVY-ION ACCELERATOR. Lunsford, J. S.; Shipley, J. P.; Sutton, J. **(Los Alamos Scientific Lab., N. Mex. (USA)).** Jul 1975. 11p. Dep. NTIS $4.00.

is indexed as:

LOS ALAMOS SCIENTIFIC LAB., N.MEX. (USA)
  100-Mhz power amplifier design and control for a heavy-ion accelerator, 32:20457 (LA-5954)
  Characterization of transuranic solid wastes from a plutonium processing facility, 32:19398 (LA-5993-MS)
  Electrical breakdown and tracking characteristics of pulsed high voltages in cryogenic helium and nitrogen, 32:19495 (LA-UR-75-1032)
  Engineering concepts for laser-fusion reactor applications, 32:19493 (LA-UR-75-736)
  Evaluation of pre-impregnated resin-glass systems for insulating superconducting magnets, 32:19583 (LA-UR-75-1099)

Report Numbers

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

L-	(Misc.)	
9389	32:20494	See N-74-35219
LA-		
2429	32:20210	Dep. NTIS, $12.00
5931	32:21563	Dep. NTIS, $5.45
LA-tr-		
75-14	32:21506	Dep. NTIS, $7.75
75-26	32:19253	Dep. NTIS, $4.00
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75-736	32:19493	Dep. NTIS, $4.00
75-791	32:20772	Dep. NTIS, $4.50
75-1331	32:19238	Dep. NTIS, $4.00
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LFEN-	(Portugal)	
165-b	32:21507	INIS

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations from *Dissertation Abstracts International, Part B* that are included in *Nuclear Science Abstracts* are available from Xerox University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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The Administrator of the Energy Research and Development Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.

Volume 33, Number 1 January 15, 1976

NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical and Separations Chemistry

Refer also to abstract 85.

1 ANALYSIS BY MEANS OF SPARK SOURCE MASS SPECTROMETRY OF MASSIVE ELEMENTAL BORON, AND, IN PARTICULAR, OF BORON FIBERS. Cueilleron, J.; Thevenot, F.; Viala, J. C. pp 27-32 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Impurities of massive elemental boron, taken in particular in the shape of boron fibers, were analyzed using a mass spectrometer by direct sparkling of the samples. All the impurities of boron, including the light elements such as H_2, C, O_2, N_2, can be determined without any previous standardizing by operating with two different magnetic fields. The lower limit of detection of a monoisotopic impurity corresponds to one atomic ppM, the determination is possible starting from ten atomic ppM. A fair reproducibility of the analysis is possible thanks to an individual correction of the width of the rays of the spectra obtained on photographic plates. Such a method of analysis allows comparison in similar boron samples of the concentration of low-content elements (less than 1000 atomic ppM) which are hardly attainable with other techniques. (auth)

Activation and Nuclear Reaction Procedures

Refer also to abstracts 671, 675 and 784.

2 (AD/A--004542) INTERPRETATION OF ACTIVATION ANALYSIS PROFILE. Roberts, D. M.; Glanzer, J. A.; Rude, D. E. (Iowa State Univ. of Science and Technology, Ames (USA). Engineering Research Inst.). Aug 1973. Contract F33615-68-C-1034. 262p. (ISU-ERI-AMES-72211). NTIS $8.50.

Activation analyses of samples containing unknown elements is usually difficult due to the presence of many lines each of which may belong to any of a number of elements. A method is presented for the interpretation of spectral data based on the identification of prominent lines characteristic of the thermal neutron activation of the elements in which all isotopes of a particular element are considered collectively, rather than individually as has been customary. Since only the prominent lines (relative intensity ≥ 0.5) belonging to the spectrum of an activated isotope are considered, much of the element-assignment-ambiguity introduced by low intensity photons is eliminated. At the heart of the procedure is a catalog of prominent line spectra for the elements. Each catalog page provides a schematic spectrum of the prominent decay photon lines produced by thermal neutron activation of the stable isotopes of a particular element. (GRA)

3 (AERE-R-7859) INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS IN ENVIRONMENTAL STUDIES OF TRACE ELEMENTS. Salmon, L. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Jun 1975. 31p. Dep. NTIS (US Sales Only) $5.00.

The application of a routine instrumental nuclear method is described in relation to environmental surveys and studies. A working rather than formal review is made of the techniques applied with particular reference to the data processing methods involved. (auth)

4 (CONF-750928-2) NEUTRON ACTIVATION ANALYSIS APPLIED TO ENERGY AND ENVIRONMENT. Lyon, W. S. (Oak Ridge National Lab., Tenn. (USA)). 1975. 13p. Dep. NTIS $4.00.

From nuclear power and applications in Latin America; Mexico City, Mexico (29 Sep 1975).

Neutron activation analysis was applied to a number of problems concerned with energy production and the environment. Burning of fossil fuel, the search for new sources of uranium, possible presence of toxic elements in food and water, and the relationship of trace elements to cardiovascular disease are some of the problems in which neutron activation was used. (auth)

5 (INIS-mf-1484) DETERMINATION OF THE CONTENTS OF 20 MICROELEMENTS IN TOBACCO BY NEUTRON-ACTIVATION ANALYSIS AFTER ELIMINATION OF ^{24}Na AND ^{42}K. Marinov, V.; Apostolov, D.; Lazarova, M. (Bylgarska Akademiya na Naukite, Sofia; Sofia Univ. (Bulgaria)). Apr 1974. 10p. (In Bulgarian). (CONF-7404114-1). INIS.

From 2nd national conference of the young physicists; Sofia, Bulgaria (10 Apr 1974).

A method is proposed for the determination of Sm, Eu, Cu, Au, As and Zr (plus 14 other microelements) by means of the neutron-activation analysis after the elimination of ^{24}Na and ^{42}K are eliminated from wet ashen tobacco (activated with different duration for the determination of the different microelements) by the batch procedure (also with different duration) with ion exchange resin Chelex 100. (INIS)

6 (LBL-4061) PROVENANCE STUDIES OF SGRAFFIATO AND LATE GREEN GLAZED WARES FROM SIRAF, IRAN. Michel, H. V.; Asaro, F.; Frierman, J. D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. 14p. (CONF-750355-1). Dep. NTIS $4.00.

From conference on applications of physical sciences to medieval archaeology; Berkeley and Los Angeles, California, USA (18 Mar 1975).

Results of neutron activation analyses of 23 elements in ceramic archaeological specimens are given. Various wares are divided into the following categories: early Sgraffiato, late Sgraffiato, late Green A, late Green B, and Samarra ware. Results are given on the following elements: Al, Ca, Dy, Mn, Na, K, U, Sm, La, Ti, Lu, Co, Sc, Fe, Cs, Cr, Ni, Eu, Ce, Hf, Ta, Th, and Yb. (JGB)

7 ACTIVATION ANALYSIS OF CESIUM AND ANTIMONY IN ROCKS AND GOLD-BEARING ORES BY THE METHOD OF SUMMARIZED COINCIDENCES. Miranskii, M. A.; Ramazanov, R. Sh. (AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). pp Book 2 p. 121-123 of Applied Nuclear Physics. Proceedings. Tashkent; "Fan" (1973). (In Russian)

From conference of junior scientists; Tashkent, USSR (Apr 1971). 1 fig.

A summarized-coincidence method was used to determine cesium in rocks and gold-bearing ores, using the ^{134}Cs isotope. A 500-mg sample was irradiated in the active zone of the reactor with a flux of 1.8×10^{13} n/cm^2.sec, in a cadmium screen, for 20 hr. The irradiated sample was cooled 20 days; the measurement required 2 min. The Cs content varied from 1 to 5×10^{-4}%. The results of the Cs determination from the 0.6- and 0.8-MeV peaks agreed. This method was used for determining Sb in the same samples from irradiation of the ^{124}Sb isotope. Radiation from ^{60}Co may interfere. With consideration of its effect, the content was 10^{-4}%. Since the summed peaks are in the high-energy

region of the spectrum (2.3 MeV), the effect of interfering radiation from ^{134}Cs and ^{46}Sc may be neglected, as also may that from isotopes not having cascade transformations because of the high resolving capacity of the spectrometer. (tr-auth)

8 RADIOACTIVATION DETERMINATION OF NOBLE METALS IN IRON METEORITES. Sil'vanovich, Yu. A.; Rakhimov, Kh.; Ganiev, A. G.; Lavrukhina, A. K. (AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). pp Book 2 p. 153-156 of Applied Nuclear Physics. Proceedings. Tashkent; "Fan" (1973). (In Russian)

From conference of junior scientists; Tashkent, USSR (Apr 1974). 3 refs.; 2 tables.

A method is presented for radioactive determination of the noble metals in samples of 12 iron meteorites of different types. Weights of 0.1 g of samples and standards are placed in quartz ampules and reactor-irradiated with 1.8×10^{13} n/cm^2.sec for 10 hr. After cooling 10–14 hr the samples with carrier (up to 1 mg) are processed and the activity was measured with a gamma scintillation spectrometer. (tr-INIS)

9 NON-DESTRUCTIVE DETERMINATION OF MANGANESE AND COPPER BY NEUTRON ACTIVATION ANALYSIS. Cheema, M. N.; Qureshi, I. H. (Pakistan Inst. of Nuclear Science and Technology, Rawalpindi). Nucleus (Karachi).; 11: No. 1,2, 13-17(Jan 1974).

6 refs.

A simple procedure has been developed for the simultaneous determination of copper and manganese using nondestructive neutron activation analysis. The specimen to be analyzed was irradiated for an appropriate time with thermal neutrons at a flux of 2×10^{13} n/cm^2.sec^1. Various factors such as the irradiation time, the radioactive decay and interference from other radionuclides were studied and optimized. For quantitative determination the γ ray spectra of the radionuclides were measured with a 3 × 3 NaI(Tl) detector coupled with a computerized multichannel analyzer. The areas under the 845-keV photopeak of M and 511-keV annihilation radiation peak of Cu were determined, and the amounts of these elements were calculated using the comparator method. The results were cross-checked with destructive activation analysis. This procedure was applied for the determination of these elements in certain IAEA and US NBS Standard Reference Materials (SRM) and in certain copper-bearing ores. (INIS)

10 ODNOVREMENNOE OPREDELENIE ALYUMINIYA I KREMNIYA V POROSHKOVYKH PROBAKH BOKSITOV I DRUGIHK ALYUMOSILIKATNYKH POROD S POMOSHCH'YU USTANOVKI NEJTRON2M. (Metodicheskie Ukazaniya). (Simultaneous Determination of Al and Si in Powder Samples of Bauxites and Other Alumosiliceous Rocks Using the Nejtron-2M System (Manual)). Lejpunskaya, D. I.; Drynkin, V. I.; Varik, V. I. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Yadernoj Geofiziki i Geokhimii, Moscow (USSR)). Moscow; Vsesoyuznyj Nauchno-Issledovatel'skij Institut Yadernoj Geologii i Geokhimii (1973). 40p. (In Russian).

3 refs.; 7 figs.; 7 tables.

A presentation is given of the main principles of neutron activation analysis by means of the Nejtron-2M unit. A description is given of the method of determining the content of alumina and silica in bauxites. Attention is devoted to problems of work organization and radiation safety measures on the Nejtron-2M unit. (auth)

11 GEOMETRY FACTORS AND FLUX CORRECTIONS IN NEUTRON ACTIVATION ANALYSIS. Piotrowicz, S. R.; Fasching, J. L.; Zdankiewicz, D. D.; Karin, R. W. (Univ. of Rhode Island, Kingston). Anal. Chem.; 47: No. 13, 2326-2328(Nov 1975).

Two possible sources of error in neutron activation analysis are variations in neutron flux over the length, width, and height of a sample and geometry factors during counting of the activated sample. Development of a sample preparation, handling, and analysis system designed to minimize these two problems as well as reducing contamination problems is described. The procedure basically involves four steps: (1) spotting a known volume of sample solution or standard solution on a filter disc and allowing it to dry in a laminar-flow clean bench; (2) sealing the disc between two layers of plastic; (3) irradiation; and (4) counting. (LK)

12 REMOVAL OF TRACE ELEMENTAL IMPURITIES FROM POLYETHYLENE BY NITRIC ACID. Karin, R. W.; Buono, J. A.; Fasching, J. L. (Univ. of Rhode Island, Kingston). Anal. Chem.; 47: No. 13, 2296-2299(Nov 1975).

An evaluation of two cleaning procedures indicates that metal contamination is leached out of polyethylene apparatus in three days. The thirteen trace elements evaluated are Al, Na, V, Cu, Cl, Br, Sb, Au, Cr, Mn, Co, Sc, and La. (auth)

13 DETERMINATION OF SILVER IN ROCKS BY NEUTRON ACTIVATION ANALYSIS. Nadkarni, R. A.; Morrison, G. H. (Cornell Univ., Ithaca, NY). Anal. Chem.; 47: No. 13, 2285-2286(Nov 1975).

Trace amounts of silver have been determined in rocks by neutron activation, followed by selective adsorption of silver on Srafion NMRR ion-exchange resin, and high resolution gamma spectrometry. (auth)

14 CARBON DETERMINATION IN SEMICONDUCTOR SILICON BY MEANS OF DEUTERON ACTIVATION ANALYSIS. Boettger, M. L.; Helbig, W.; Niese, S. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Isotopenpraxis; 11: No. 4, 127-129(Apr 1975). (In German).

By means of irradiation with deuterons of 3.5 MeV the carbon contents of semiconductor silicon can be determined without the need of chemical separation. The extent of interferences, such as the increase of the C-content by SiC-inhomogeneities, by lapping compound, and by oil in vacuum was investigated. Interferences can be eliminated or reduced to a minimum by etching of defined surface layers before and after the irradiation. For carbon percentages over 70 wt ppb (experimental detection limit) the relative error can be regarded as usually less than 30%. (auth)

15 DETERMINATION OF MANGANESE, COPPER, AND ZINC IN HUMAN LIVER SPECIMENS BY ACTIVATION ANALYSIS. Leondardt, W.; Niese, S.; Jaross, W.; Hanefeld, M.; Schentke, K. U.; Meissner, D. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Isotopenpraxis; 11: No. 4, 130-133(Apr 1975). (In German).

Parts of liver biopsy specimens of man with about 0.4 mg of mass are tested for their contents of manganese, copper, and zinc. The specimens are freeze-dried and activated within quartz tubes in the Rossendorf Research Reactor at a flux of thermal neutrons of about 2.10^{-13} n cm^{-2} s^{-1}. After chemical separations using anion exchangers the activities of ^{56}Mn, ^{64}Cu, and ^{69m}Zn are measured within the NaI(Tl) scintillation detector. Separately, in any specimen we determine the triglyceride content of the liver. Twenty specimens of normal persons with controlled carbohydrate and lipid metabolism had, related to dry mass, 6.3 ppM Mn, 30 ppM Cu, and 164 ppM Zn. These concentrations fairly well agree with literature data. In cases of fatty liver and hypertriglyceridemia the metal concentrations were diminished. We observed positive correlations between the metal concentrations and negative correlations between the concentrations of metals and triglycerides. (auth)

16 NEUTRON ACTIVATION METHOD FOR THE DETERMINATION OF IMPURITIES IN BORON. Krasivina, L. E.; Lobanov, E. M.; Usmanova, M. M. (Inst. of Nuclear Physics, Tashkent). pp 5-14 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian)

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132–P2.

An instrumental method was developed for the quantitative determination of the impurities Al, V, Mg, Cu, Cl, Na, Mn, W, Fe, Br, Mo, and Ta in crystalline and powdered B by irradiation with reactor neutrons and a neutron generator. Theoretical and experimental procedures are discussed with consideration of the self-screening of the neutrons by the B. An evaluation was made of the sensitivity and precision of the analysis for different experimental conditions. The results obtained were compared with other analytical methods. (tr-auth)

17 SODIUM CONTENT OF INDIAN BUFFALO MILK. Lalit, B. Y.; Shukla, V. K.; Ramachandran, T. V. (Bhabha Atomic Research Centre, Bombay). Radiochem. Radioanal. Lett.; 22: No. 6, 385-390(27 Sep 1975).

Nondestructive neutron activation analysis has been used to determine the sodium content of Indian buffalo milk. The details of the analytical procedure are briefly described. (auth)

18 PROOF OF THE IDENTITY OF TWO HEROIN SAMPLES VIA THE DETERMINATION OF TRACE ELEMENTS BY MEANS OF ACTIVATION ANALYSIS. Molls, H. Muenster, Ger.; Univ. Muenster (1974). 152p. (In German). INIS.

Thesis.

Analysis of two samples of heroin on different alkaloid components using gas chromatography or thin-layer chromatography is not sufficient to clearly determine their identity. On the other hand, a "specimen" is assumed having the same qualitative and quantitative composition of trace elements which, to a high probability, excludes a different origin of the samples. A nondestructive activation analytical method was developed, which allows the determination of 17 elements next to each other. The values were statistically evaluated for copper, mercury, and zinc. The determination of these 3 elements already allowed the proof of identity. The measured gamma spectra of the samples were evaluated using electronic data processing for which a system of various computer programs was used. (GE)

19 PRECISION NEUTRON ACTIVATION ANALYSIS OF LUNAR AND GEOLOGICAL SAMPLES. Miller, M. D. Lexington, KY; Univ. of Kentucky (1974). 224p. University Microfilms Order No. 75-18,498.

Thesis (Ph. D.).

Improvements were made in systems for the determination of O, Si, Al, Mg, and Fe in lunar and geological samples by 14 MeV neutron activation analysis. Methods were developed for use of a 1 mg ^{252}Cf neutron source in the determination of Mn and Na in lunar samples. The effects of geometric reproducibility, 14 MeV neutron flux instability, and dead time and pulse pile-up in the neutron monitor and counting systems were examined. A new method of gamma-ray peak integration for use with NaI(Tl) spectra is presented. Major and minor elemental abundance data on three Apollo 14 and three Apollo 15 samples were determined. Data on the elements above are presented for four Apollo 16 crystalline rocks, seven Apollo 16 soils, seven Apollo 16 breccias, three Apollo 17 basalts, one Apollo 17 breccia, and ten Apollo 17 soils. Elemental abundance summations for these samples average 98.9 +- 0.2 percent, and would be higher by a few tenths of one percent if elements not determined (e.g., K, Cr, P and S) were included. Evidence suggestive of an oxygen deficiency in lunar materials was obtained. Possible causes are discussed. Correlations of iron with aluminum and iron with manganese are presented for data from all Apollo landing sites. An overview of elemental abundance correlations for 21 major, minor, and trace elements in 105 lunar samples from all Apollo missions is presented. Correlations of 17 of these elements can be satisfactorily explained by their occurrence in the minerals plagioclase, pyroxene, and ilmenite. (Diss. Abstr. Int., B)

Chemical and Spectral Procedures

Refer also to abstract 120.

20 (AD/A-004528) AEROSOL-IONIZATION METHOD OF CHECKING MICROIMPURITIES IN GASES. Bogorad, G. I.; Brodskii, M. F. 25 Nov 1974. Translated by F. C. Vaughn from pp 186-194 of Radioizotopnye Sredstva Kontrolya i Avtomatizatsii Tekhnologicheskikh Protsessov v Promyshlennosti, Moscow, 1972. (FTD-MT-24-2144-74). 18p. NTIS $3.25.

The aerosol-ionization method of gas analysis is discussed. The essence of the aerosol-ionization method consists of the selective conversion of the monitored component of the gaseous mixture to an aerosol and the detection of aerosol particles in the ionization chamber with the ionization source. Ionization and ionic current are discussed. (GRA)

21 (ARH-SA-219) ION EXCHANGE SEPARATION AND MASS SPECTROMETRIC ANALYSIS OF URANIUM FOR SOLUTIONS CONTAINING PLUTONIUM. McBride, K. C. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Jun 1975. 14p. (CONF-750673-5). Dep. NTIS $4.00.

From 30th northwest regional meeting American Chemical Society; Honolulu, Hawaii, USA (12 Jun 1975).

An ion exchange technique separates plutonium from uranium using Dowex-1 resin and a methanol–HCl plutonium elutriant. The method is applicable to both trace uranium determination and uranium isotopic distribution analysis by mass spectrometry. Distribution coefficients for plutonium, and elution curves for uranium and plutonium are shown. For uranium analysis the percent relative standard deviation is 0.8 at 120-2400 micrograms uranium per gram plutonium and 5.0 at 5 micrograms uranium per gram plutonium. (auth)

22 (CNEA-392) DIRECT DETERMINATION BY ATOMIC ABSORPTION OF CALCIUM, COBALT, AND ZINC IN NUCLEAR GRADE URANIUM OXIDE. Guido, O. O.; Amaya, C. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1975. 19p. (In Spanish). Dep. NTIS (US Sales Only) $4.00.

A study was made of the effect of flame composition (fuel: C_2H_2, comburent: air or N_2O) and location of the burner on the three analyses in a nitric medium, in presence and in absence of uranium. For calcium it was necessary to use N_2O, while for zinc and cobalt the use of air was found to be more adequate. The standard additions method for the quantitative determination was adopted. The absorption at the analytical wavelength not corresponding to the elements studied was determined by comparison between this method and another indirect one, using extraction with TBP, and the results were expressed as equivalent concentrations. Confidence intervals of the analytical results were evaluated statistically using a scheme of calculation adapted to the proposed method. This evaluation allowed an estimation of the detection limits (calcium: 5 ppm, cobalt: 3 ppm, zinc: 2 ppm). (auth)

23 (GEPP-187) APPLICATION OF JONES' EQUILIBRIA TO LOW RESOLUTION MASS SPECTROMETER ANALYSES OF HYDROGEN ISOTOPE MIXTURES. Mehrhoff, T. K.; Humphries, J. O. (General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.). 24 Sep 1975. Contract E(29-2)-656. 18p. Dep. NTIS $4.00.

Identification of the constituents in a hydrogen/hydrogen isotope mixture of gases can be difficult with a mass spectrometer of low resolving power. However, the percentage of HT in a mixture may be accurately estimated by using equilibrium constants developed by W. M. Jones. The use of two of those constants, K_2 and K_3, is evaluated for measuring the amount of HT in a mixture. The constants were evaluated for uranium hydride bed gaseous sample analysis. Evaluation is made with both error propagation and a comparison with data obtained with a mass spectrometer of high resolution. Recommended calculation formulas are given, as are error propagation derivations. Improvements in analysis accuracy are realized by use of a series of calculation formulas rather than relying upon a single equilibrium to cover a wide range of mixtures and sampling conditions. The derived error propagation formulas may be applied generally to all equilibrated low resolution mass spectrometer analyses of hydrogen isotope mixtures, with appropriate selection of delta values. (auth)

24 (N-75-16644) POLAROGRAPHIC ANALYSIS OF OXIDE MIXTURES IN MELTS. Sevryukov, N. N.; Skurupatis, K. A.; Kintana, M. T. Translated from Zavod. Lab.; 40: No. 4, 373-375(1974). 8p. (NASA-TT-F-16140). NTIS $3.25.

Conditions for the polarographic determination of several cations Zn(2+), Pb(2+), Cu(2+), and Cd(2+) and for the lanthanides La(3+), Pr(3+), Gd(3+) and Dy(3+) in an ammonium nitrate melt were determined. The potentials of peaks of the polarograms for these cations in the ammonium nitrate melt are given. Data on the determination of lanthanum, rare-earth elements, and zinc in mixtures with various oxides are presented. Since cerium dioxide does not react with ammonium nitrate, a method was developed for determining lanthanides in the presence of cerium dioxide, using an ammonium nitrate melt. The sensitivity of the method depends on the completeness of removal of moisture from the melt by electrolysis. The minimum amount of lanthanides that can be reliably determined is about 0.0015 g-ion/kg of melt (or about 0.006 g in the polarographic cell used). (STAR)

25 (PB-238989) MINOR ELEMENTS IN NONMAGNETIC CONCENTRATES FROM ALASKA. Final Report. Overstreet, W. C.; Hamilton, J. C.; Boerngen, J. G.; Rosenblum, S.; Marsh, W. R. (Geological Survey, Reston, Va. (USA)). 1974. 441p. (USGS-GD-74-039). NTIS $11.25.

Semiquantitative spectrographic analyses of 1,969 nonmagnetic concentrates were performed, mainly from former gold placer district. Ratios of background to anomalous values seemingly identify areas worthy of further exploration for base metals, platinum, molybdenum, tin, tungsten, and europium. (GRA)

26 (SM--201/9) SIMPLIFIED METHOD FOR THE PREPARATION OF MICRO SAMPLES FOR THE SIMULTANEOUS ISOTOPIC ANALYSIS OF URANIUM AND PLUTONIUM. Carter, J. A.; Walker, R. L.; Eby, R. E.; Pritchard, C. A. (Oak Ridge National Lab., Tenn. (USA)). 1974. Contract W-7405-Eng-26. 17p. (CONF-751017--12). Dep. NTIS $4.00.

From symposium on safeguards of nuclear materials; Vienna, Austria (20 Oct 1975).

A basic anion resin is employed to selectively adsorb plutonium and uranium from 8 M HNO_3 solutions containing dissolved spent reactor fuels. After a few beads of the resin are equilibrated with the solution, a single bead is used for establishing the isotopic composition of plutonium and uranium. The resin bead separation essentially removes all possible isobaric interference from such elements as americium and curium and at the same time eliminates most fission product contamination in the mass spectrometer. Small aliquots of dissolver solution that contain 10^{-6} g of U and 10^{-8} g of Pu are adequate for preparing about ten resin beads. By employing a single-focusing, tandem-magnet-type mass spectrometer, equipped with pulse counting for ion detection, simultaneous plutonium and uranium assays are obtained. The quantity of each element per bead may be as low as 10^{-9} to 10^{-10} g. The technique of isotope dilution can be coupled with the ion exchange bead separation and used effectively for measuring the total quantity of U and Pu. The technique possesses advantages such as reduced radiation hazards from the infinitely smaller samples, thus less shielding and transport cost for sample handling; greatly simplified chemical preparations that eliminate fission products and actinide isobaric interferences; and the minor isotopes are more precisely established. (auth)

27 (UCRL-77379) MINERALOGICAL CONSIDERATIONS IN LEACHING OF PRIMARY COPPER SULFIDES AT ELEVATED TEMPERATURES AND PRESSURES. Leach, D. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Oct 1975. Contract W-7405-Eng-48. 24p. Dep. NTIS $4.50.

The leaching characteristics of four different ores in sulfuric acid systems pressurized with oxygen are described. The variations in the leaching characteristics between different ores can be largely attributed to differences in mineralogy. Certain gangue mineral alteration phases produced during leaching may trap copper from solution, as well as reduce the porosity of the ore. In addition, the formation of secondary copper sulfides, digenite, and covellite may limit the extraction of copper if the supply of oxygen is restricted to chalcopyrite. Apparently, the key consideration for successful leaching is maximizing the rate of oxidation of the sulfides and, at the same time, minimizing the rate of gangue mineral alteration. This can be accomplished at high oxygen pressures and moderate temperatures (70 to 90°C) and low pH (less than or equal to 2.0). The ideal ore mineralogy is one that is low in carbonates and easily altered Fe-Mg minerals such as biotite and hornblende, and one that has acceptable pyrite/chalcopyrite ratios. (auth)

28 2-ACYL-1, 3-INDANDIONES AS REAGENTS FOR GRAVIMETRIC DETERMINATION OF Fe(III) AND UO_2(II). Zacharova-Kalavska, D. (Komenskeho Univerzita, Bratislava (Czechoslovakia). Prirodovedecka Fakulta). Acta Fac. Rerum Natur. Univ. Comenianae, Chim.; No. 14, 103-107(1974). (In German).

Gravimetric determination of uranium by precipitation of the uranyl ion and of Fe with 2-acetyl-1, 3-indandione or 2-benzoyl-1, 3-indandione is described. (INIS)

29 USE OF N,N'-DIPHENYLTHIOCARBAMYL-HYDROXAMIC ACID FOR AMPEROMETRIC DETERMINATION OF MOLYBDENUM(VI). Gallai, Z. A.; Sheina, N. M.; Polikarpova, N. V.; Ilyushina, A. M. (Moskovskij Gosudarstvennyj Univ. (USSR). Kafedra Analiticheskoj Khimii). Vestn. Mosk. Univ., Ser. II. Khim.; 15: No. 5, 582-584(Sep 1974). (In Russian).

For English translation see the journal Mosc. Univ. Chem. Bull.

A new reagent was studied for determination of Mo(VI) by amperometric titration N,N'-diphenylthiocarbamylhydroxamic acid (DPTCHA). Conditions were selected that would ensure simultaneous occurrence of a chemical reaction between Mo(VI) and the reagent and electrochemical oxidation of excess reagent on the electrode used for indicating the titration end point. At the graphite electrode potential, +0.95 V, with 4.5–6.5 M H_2SO_4, results were quantitative and reproducible. The ratio of Mo(VI) to reagent at the titration end point was constant and equalled 1:3. Analysis of the precipitate obtained under titration conditions showed a Mo/reagent ratio of 1:2. Thus we consider that one molecule of reagent is decomposed in reducing Mo(VI) to Mo(V), which then forms a complex with DPTCHA in the ratio 1:2. The reagent is selective, and the method developed may be used for determining Mo in standard samples of steel 159 and ferromolybdenum 168. (INIS)

30 ANALYSIS OF PETROLEUM FOR TRACE METALS: DETERMINATION OF TRACE QUANTITIES OF BERYLLIUM IN PETROLEUM AND PETROLEUM PRODUCTS BY HEATED VAPORIZATION ATOMIC ABSORPTION. Robbins, W. K. (Exxon Research and Engineering Co., Linden, NJ); Runnels, J. H.; Merryfield, R. Anal. Chem.; 47: No. 13, 2095-2101(Nov 1975).

Two analytical methods are described for the direct determination of beryllium in petroleum and petroleum products by heated vaporization atomic absorption (HVAA). The methods are applicable to the determination of 1 to 50 ng Be/g with a precision (relative standard deviation) of 10 percent at the 30 to 40 ng/g level. The methods were cross-checked in cooperating laboratories and the results indicate that reliable analyses can be obtained when the methods are applied in other laboratories. (auth)

31 PRECISE ISOTOPIC ANALYSIS OF LEAD IN PICOMOLE AND SUBPICOMOLE QUANTITIES. Tera, F.; Wasserburg, G. J. (California Inst. of Tech., Pasadena). Anal. Chem.; 47: No. 13, 2214-2220(Nov 1975).

A microanalytical procedure for the separation of Pb and U and their determination by isotope dilution-mass spectrometry is described. It is shown that high precision isotopic analysis of as little as 8×10^{11} Pb atoms is readily achievable. The level of Pb contamination is reduced to as little as 4×10^{10} atoms and the blank fluctuation is controllable. In the special case where the chemical separation could be omitted, 4×10^{10} Pb atoms were isotopically analyzed with a blank correction of 6×10^9 Pb atoms. This procedure was applied to a 0.2-mg lunar sample containing 2.5 ppM Pb and 1 ppM U and the U–Pb isotopic measurements obtained are fully compatible with measurements on large samples. In addition, Pb on the surface of individual lunar glass balls of 150-300 mu m diamter was measured. Extension of this approach to other heavy metals may be possible. (auth)

32 LIQUID–LIQUID ION-SELECTIVE ELECTRODE RESPONSIVE TO UNIVALENT ANIONS. Vosta, J.; Havel, J. (Faculty of Science, Brno). Chem. Scr.; 3: 109-115(1973).

The construction of such an electrode containing a PTFE membrane soaked in 0.1m tetrahexylammonium iodide dissolved in dodecanol is described. A silver–AgI reference electrode is used. The I^--selective electrode gives satisfactory rectilinear response to I^- and ClO_4^- in the range 0.5mm to M, but low response for other univalent anions, and no response for bivalent anions. The selectivity coefficient of the electrode for I^-–Cl^- and ClO_4^--citrate is given. (Anal. Abstr.)

33 VERSIONS OF ENERGY-DISPERSIVE X-RAY EMISSION ANALYSIS. V. Versions of Analytical Investigation of Materials. Thuemmel, H. W. Isotopenpraxis; 11: No. 5, 172-180(May 1975). (In German).

A review is given of the newest developments in semiconductor spectrometry and pulse-height analyzers in the x-ray emission analysis of materials. (58 references) (JSR)

34 USE OF FATTY ACIDS OF THE C_7–C_9 FRACTION FOR DETERMINING RARE-EARTH ELEMENTS IN MINERAL RAW MATERIALS. Galkina, L. L. (Central Asian Scientific-Research Inst. of Geology and Mineral Raw Materials, Tashkent). Ind. Lab. (USSR) (Engl. Transl.); 41: No. 3, 327-329(Mar 1975).

Translated from Zavod. Lab.; 41: No. 3, 272-274(Mar 1975).

Methods were developed for the determination of total rare earths in silicate rocks, ores, fluorites, and phosphorites with a sensitivity of 0.0005-0.001% for rocks, and fluorites, 0.002% for phosphorites. From various aliquot portions of one weighed sample, total rare earths are determined by a photometric method with arsenazo III, and the individual rare earth elements are determined by a spectral method. (LK)

35 LUMINESCENCE DETERMINATION OF BERYLLIUM WITH RESORCYLAL-O-AMINOPHENYLARSONIC ACID. Tashkhodzhaev, A. T.; Zel'tser, L. E.; Talipov, Sh. T.; Khikmatov, Kh. (Tashkent State Univ.). Ind. Lab. (USSR) (Engl. Transl.); 41: No. 3, 338-339(Mar 1975).

Translated from Zavod. Lab.; 41: No. 3, 280-281(Mar 1975).

A luminescence method based on the complex-forming reaction of resorcylal-o-aminophenylarsonic acid was developed for the determination of beryllium in various samples with a sensitivity of 0.4×10^{-3} μg/ml. Beryllium can be determined in the presence of copper (500-fold excess by weight), aluminium (150), zinc (150), zirconium (150), titanium (500), nickel, chromium, cadmium, molybdenum, cobalt, lanthanum, and indium (1000), and Fe^{3+} (250). (LK)

36 CHROMATOGRAPHIC DETERMINATION OF WATER, ALDEHYDES, ALCOHOLS, AND LOWER CARBOXYLIC ACIDS IN THE PRODUCT FROM RADIATION-CHEMICAL CARBOXYLATION OF METHANE. Klapishevskaya, Z. B.; Kuklin, Yu. S.; Timofeev, V. D. Ind. Lab. (USSR) (Engl. Transl.); 41: No. 3, 342-343(Mar 1975).

Translated from Zavod. Lab.; 41: No. 3, 282-283(Mar 1975).

A method was developed for the joint determination of various classes of oxygen-containing compounds in solutions. Water, alcohols, acetone, and aldehydes (except formaldehyde) were separated on a chromatographic column of Porapak S. Separation of formaldehyde from water and formic acid from acetic acid was accomplished with polyfluoroethylene resins with polyethylene glycol and azelaic acid as the stationary phase. The carrier gas was helium. (LK)

37 VERSIONS OF ENERGY-DISPERSIVE X-RAY EMISSION ANALYSIS. IV. Versions of the Determination of Contents. Thuemmel, H. W. (Zentralinstitut fuer Isotopen- und Strahlenforschung, Leipzig). Isotopenpraxis; 11: No. 4, 117-124(Apr 1975). (In German).

The review of x-ray emission analysis is continued with a discussion of the construction principles of x-ray emission analyzers and their areas of use. Portable analyzers in general and bore hole probes in particular are discussed. Laboratory x-ray emission analyzers are then considered. Process or on-line analyzers are also considered. (81 references) (JSR)

38 PRECISE MEASUREMENTS OF CESIUM IN THE OCEAN BY FLAME EMISSION SPECTROMETRY. Folsom, T. R.; Hansen, N.; Parks, G. J. Jr.; Wrinz, W. E. Jr. (Scripps Inst. of Oceanography, La Jolla, CA). Appl. Spectrosc.; 28: No. 4, 345-350(1974).

An automatic flame emission spectrometer was developed for measuring traces of cesium in sea water samples with precision enough to demonstrate for the first time some significant concentration variations of this element in the ocean. Extremely reproducible comparisons of standard and unknown solutions are effected by a programmed sample changer employing a novel distribution valve. Following each recording of the peak emission, the emission from a nearby spectral baseline also is automatically recorded by using a simple accessory added to the monochromator.

A Plexiglas refractor slab mounted on an axis in front of the exit slit is rotated a few degrees by pulses from a programmer that is under command of a standard desktop calculator. Analyses of test samples containing about 0.3 mu g of cesium replicated better than 0.3 percent. Surface cesium concentrations in the North Pacific were shown to vary less than 0.5 percent; however, typically deep water contained about 1.4 percent lower average concentrations than surface water. (auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 694, 696, 697, 699, 706, 754, 778, 1001, and 1100.

39 (CNEA-383) DETERMINATION OF URANIUM-235 BY DIFFERENTIAL GAMMA SPECTROMETRY. Suner, A. A.; de Batistoni, A. M. L. G.; Botbol, J. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1974. 8p. (In Spanish). Dep. NTIS (US Sales Only) $4.00.

A method for the determination of ^{235}U contained in solutions of uranium, by gamma spectrometry with a Ge(Li) detector is described. Radium-226 is coprecipitated in $BaSO_4$. The activity at 186 keV is measured, subtracted by the corresponding of a standard. The detection limit is 1% of increment of ^{235}U over the standard. (auth)

40 (LBL-4022) NON-DISPERSIVE SOFT X-RAY FLUORESCENCE ANALYSES. Herbert, A. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1975. Contract W-7405-ENG-48. 15p. (CONF-750358-1). Dep. NTIS $4.00.

From conference on applications of the physical sciences to medieval ceramics; Los Angeles, California, USA (22 Mar 1975).

In a nondispersive x-ray fluorescence analysis system, all x-rays incident on the detector are analyzed according to energy in a time sharing manner. The spectrometer and techniques described were designed to take advantage of the features of a nondispersive detector. These include sensitivity, relatively short geometry, and the ability to detect oxygen and sodium x-rays at the low energy end of the elemental scale. Results are given for analyses of Sirof pottery samples and standard USGS rocks. (LK)

41 (RFP-Trans--167) RECENT DEVELOPMENTS IN PLUTONIUM ANALYSIS. 1974. Translation of CEA-CONF--2692. 16p. Dep. NTIS $4.00.

The development of the analytical chemistry of plutonium has been pursued in three directions in recent years: high-precision analysis, atomic absorption analysis and x-ray fluorescence analysis. The methods of titration by oxydoreduction permit precision between 0.05 and 0.1 percent in determining plutonium in metal and mixed oxides from the core [literally drawplate, screw plate] of fast neutron reactors. Atomic absorption permits determination of 10^{-6} to 10^{-7} g of plutonium. An x-ray fluorescence installation is used for determination of plutonium and uranium in reprocessing solutions. (auth)

42 (UCRL-76751) ABSORPTION CORRECTIONS FOR X-RAY FLUORESCENCE ANALYSIS OF ENVIRONMENTAL SAMPLES. Bazan, F.; Bonner, N. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Aug 1975. 11p. (CONF-750831-4). Dep. NTIS $4.00.

From 24th annual conference on applications of x-ray analysis; Denver, Colorado, USA (6 Aug 1975).

The discovery of a very simple and useful relationship between the absorption coefficient of a particular element and the ratio of incoherent to coherent scattering by the sample containing the element is discussed. By measuring the absorption coefficients for a few elements in a few samples, absorption coefficients for many elements in an entire set of similar samples can be obtained. (auth)

43 (UCRL-Trans--10732) DETERMINATION OF NEPTUNIUM IN THE PRESENCE OF PLUTONIUM AND URANIUM BY X-RAY SPECTROMETRY. Ertel, D.; Wettstein, W. Translated from Z. Anal. Chem.; 266: No. 1, 29-30(1973). 6p. Dep. NTIS $4.00.

Methods are discussed for overcoming difficulties caused by overlapping of peaks in the x-ray fluorescence analysis of neptunium in the presence of plutonium and uranium. Apart from chemical separations, there are two possibilities of attenuating or eliminating interference due to peak overlap, namely the use of analyzer crystals with larger dispersion or measurement of lines of a higher order. (LK)

44 REDUCTION OF SPURIOUS BACKGROUND PEAKS IN ELECTRON SPECTROMETERS. Froitzheim, H.; Ibach, H.; Lehwald, S. (Institut für Grenzflächenforschung und Vakuumphysik der Kernforschungsanlage Jülich GmbH, 517 Jülich, Germany). Rev. Sci. Instrum. 46: No. 10, 1325-1328 (Oct 1975).

Electron spectrometers working with electrostatic deflection are characterized by a typical background structure. Experimental investigations and model calculations for a 127° analyzer show that the major part of this background is caused by specular reflections of the electrons from the deflection plates towards the exit slits. The background is reduced by a factor >10 when the deflection plates are appropriately corrugated. (auth)

45 RADIOISOTOPE X-RAY METHOD OF DETERMINING HEMATITE IN IRON ORE USING ^{55}Fe AND ^{109}Cd SOURCES. Bochenin, V. I.; Krechmel, V. G. (Karaganda Polytechnical Inst., USSR). Ind. Lab. (USSR) (Engl. Transl.); 41: No. 3, 384-385(Mar 1975).

Translated from Zavod. Lab.; 41: No. 3, 313-315(Mar 1975).

A portable x-ray diffractometer was prepared and a method of accelerated radioisotope determination of hematite in iron ore in production conditions was developed. The medium being analyzed consisted of hematite ore in whose composition the following basic components were incorporated: hematite (Fe_2O_3) 30-40%, magnetite (Fe_3O_4) 5-9%, quartz (SiO_2) 10-15%, barium oxide (BaO) 0.5-8%, and aluminum oxide (Al_2O_3) 0.9-3%. (auth)

46 RADIOISOTOPE DETERMINATION OF CARBON IN THE SURFACE LAYERS OF CARBON-STEEL PARTS. Bochenin, V. I.; Krechmer, V. G. (Karaganda Polytechnical Inst., USSR). Ind. Lab. (USSR) (Engl. Transl.); 41: No. 3, 396-397(Mar 1975).

Translated from Zavod. Lab.; 41: No. 3, 322-323(Mar 1975).

A device and method for determining carbon in the surface layers of components after chemical and thermal treatment were developed. The radioisotope source was ^{55}Fe. The method uses the width of the 110 diffraction line of ferrite. The carbon concentration was determined from a calibration curve drawn up from specimens 40 × 2 mm made of steels St 3, 45, U-7, U-8, and U-9. The time needed to determine carbon in one specimen is 25-30 min. There is about 15% relative discrepancy between the radioisotope and chemical analysis results. (LK)

47 POTENTIAL ERRORS IN THE RADIOASSAY OF ^{125}I. Hunter, D.; Dratz, A. F.; Rohrer, R. H.; Coberly, J. C. (Emory Univ., Atlanta). J. Nucl. Med.; 16: No. 10, 952-954(Oct 1975).

The radioassay of very small ^{125}I samples in both conventional and side-hole well crystal scintillation counters was investigated. Using a multichannel analyzer, the source was counted at various positions within these well crystals. The effect of using a single-channel pulse-height analyzer was simulated by summing the counts over a 24-keV range across the primary peak, over a 30-keV range across the sum-coincidence peak, and over a 56-keV range across both peaks. In all crystals the primary peak was independent of sample position within the well over a range of several centimeters. The contribution of the sum-coincidence peak varied significantly with sample position in the conventional well crystals. With the side-hole crystal the counts contributed by the sum-coincidence peak exhibited a 2-cm plateau. (auth)

Separation Procedures

Refer also to abstract 1207.

48 (ANL-Trans-1001) INFLUENCE OF GEOMETRY RELATIONS OF THE SUPPORT MATERIALS ON THE CAPACITY OF AN EXTRACTION CHROMATOGRAPHY SYSTEM. I. Variation of Total Capacity and the Distribution Coefficient of Eu^{3+} in the System HDEHP-SiO_2-HCl as a Function of the Pore Size of the Support Materials (Matrices). Nolte, R. F.; Specht, S.; Born, H. J. Translated from J. Chromatogr.; 110: 239-251(1975). 15p. Dep. NTIS $4.50.

49 EXTRACTIVE METALLURGY OF ZIRCONIUM—A REVIEW OF PROGRESS IN INDIA. Subramanyam, R. B.; Saratchandran, N.; Sundaram, C. V. (Nuclear Fuel Complex, Hyderabad (India)). J. Sci. Ind. Res.; 32: No. 12, 672-680(Dec 1973).

From international symposium on industrial metallurgy; Bangalore, India (9 May 1972). 21 refs., 4 figures.

The initial work done at the Department of Metallurgy, Indian Institute of Science, Bangalore, to separate zirconium and hafnium by selective vapor phase dechlorination of $ZrCl_4$, selective reduction of $ZrCl_4$ with Al, and fused salt electrolysis of zirconium from chloride and fluoride baths during the mid-fifties has been discussed. Pilot plant investigations taken up at the Bhabha Atomic Research Centre, Trombay, for fractional crystallization of K_2ZrF_6, solvent extraction separation with the TBP-nitrate system and the chloride metallurgy of zirconium for producing ductile zirconium sponge have also been discussed. The fluidized bed technique developed for the direct chlorination of low hafnium scrap generated during the production of zircaloy tubes into zirconium tetrachloride for zirconium production is described. Flowsheets are given for different processes and integrated facilities now available at the Nuclear Fuel Complex,

Hyderabad, for the production of nuclear grade zirconium sponge from Indian zircon on a scale of 80 tonnes per year are given. (auth)

50 SYNTHESIS AND INVESTIGATION OF ABSORPTIVE CAPACITY OF COMPLEXING POLYMERS CONTAINING N-, O-, AND S. Nikiforova, L. Ya.; Zubakova, L. B.; Korshak, V. V. (Moskovskij Khimiko-Tekhnologicheskij Inst. (USSR)). Tr. Mosk. Khim.-Tekhnol. Inst.; No. 74, 167-169(1973). (In Russian).

A study was made of the preparation of adsorbents of N-, O-, and S-containing complexing polymers, and also of their capacity in adsorbing $Cd(NO_3)_2$, $UO_2(NO_3)_2$, $AgNO_3$ and other salts from aqueous solution. The complexing adsorbents were obtained by polymerizing vinyl lactams, vinyl piridines and divinyl monomers (polymerization initiator is the dinitride of azoisobutyric acid, and the stabilizer is a 1% starch solution saturated with sodium chloride). The N-, O-, and S-containing polymers possess complexing properties for a series of metal salts of 0.5 to 6.8 meq/g and for halides of 3.3 to 16.7 meq/g. The sorbents containing the pyridine ring in their structure also possess basic properties with a static exchange capacity of 2.5 to 3.3 meq/g for HCl. Sorption isotherms were experimentally determined for the following salts from aqueous solution by poly(vinyl thiopyrrolidone) and by poly(vinyl thiolactate): $AgNO_3$, $Na_3Ag(S_2O_3)_2$, $Cu(NO_3)_2$, $Fe(NO_3)_3$, $Cd(NO_3)_2$, and $UO_2(NO_3)_2$. Distribution coefficients of the element were calculated. (tr-INIS)

Inorganic, Organic, and Physical Chemistry

Refer also to abstract 85.

Chemical and Physicochemical Properties

Refer also to abstracts 133, 138, and 1120.

51 (AD/A-003940) ORGANOMETALLOPORPHYRINS. Tsutsui, M.; Hrung, C. P. (Texas Agricultural and Mechanical Univ., College Station (USA). Dept. of Chemistry). Nov 1974. Contract N00014-68-A-0308-0006. 26p. NTIS $3.75.

Pub. in New York Academy of Sciences, Annuales v235 p 140-151 1974.

Rapid progress in the field of chemistry on organometalloporphyrins is reviewed. Chemistry of vitamin B_{12}, $MP(Re(CO)_3)_2$, $(H\text{-}MP)\text{-}Re(CO)_3$, $(H\text{-}MP)\text{-}Tc(CO)_3$, $MP(Tc(CO)_3)_2$, $TPP(Re(CO)_3)_2$, (o-phenyl)RhIV(TPP)-Cl, $CH_3CH_2\text{-}Rh(IV)(OEP)$, TPPRuCO and others are discussed. (P = porphyrin). (GRA)

52 (AD/A-004868) EXCITATION AND VAPORIZATION IN ALUMINUM AND URANIUM SUBJECTED TO HIGH PRESSURE SHOCKS. Final Report, 1 May 73-30 August 1974. Fluegge, R. A. (Calspan Corp., Buffalo, N. Y. (USA)). Jan 1975. Contract F30602-73-C-0157. 54p. (CALSPAN-WB-5320-A-1). NTIS $4.25.

Both uranium and aluminum were shock heated and subsequently allowed to expand into a large, high altitude test chamber. No free uranium atoms were observed. Electronically excited aluminum was seen at real times that corresponded to values 10,000 times longer than the known radiative lifetime of the states involved. This means that sizeable numbers of free aluminum atoms are created using shock heating techniques, and further that many of these same atoms are formed in a metastable state or states which lie several electron volts above the ground state. The effects of this metastable on the reaction chemistry are considered; electronically and vibrationally excited A10 can readily be formed if the postulated atomic metastable atom is the 4P state in chemistry occurring during atmospheric release. (GRA)

53 (AED-CONF-75-080-011) TESTING OF THE APPLICABILITY OF REFERENCE ELECTROLYTES TO DETERMINE THE ION MOBILITY IN NON-AQUEOUS ELECTROLYTE SOLUTIONS WITH THE AID OF THE RADIOISOTOPE METHOD. Marx, G.; Strauss, L.; Fusban, H. U. (Freie Univ. Berlin (F. R. Germany). Inst. fuer Anorganische Chemie). 1975. 8p. (In German). INIS.

From chemical lecturer meeting; Duesseldorf, F. R. Germany (7 Apr 1975).

In the investigation into transport processes and the solvent-solvate interaction of non-aqueous electrolyte solutions, conductivity measurements were carried out to determine the ion mobility as a key parameter of the interaction. By means of reference electrolytes transfer numbers for I^- and ClO_4^- in DMSO were determined according to the moving boundary method. Four independent measurements were made of transfer numbers of LiI, NaI, KI, and $(C_2H_5)_4NI$ by means of the radioisotope method using Co-60 and C-14 radioactive indicators. (GE)

54 (CEA-R-4675) ABSOLUTE DETERMINATION OF THE DEUTERIUM CONTENT OF A HEAVY WATER SAMPLE D_2O, MEASUREMENT OF ITS ABSOLUTE DENSITY. Calculation of the Absolute Density of Isotopically Pure $D_2{}^{16}O$. Ceccaldi, M.; Riedinger, M.; Girard, G.; Menache, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Recherche et Analyse; Bureau International des Poids et Mesures, 92 - Sevres (France); Institut Oceanographique, 75 - Paris (France)). Jul 1975. 39p. (In French). Dep. NTIS (US Sales Only) $5.00.

The absolute density of two heavy water samples rich in deuterium (with a grade higher than 99.9%) was determined by the hydrostatic method. The exact isotopic composition of this water (hydrogen and oxygen isotopes) was very carefully studied. A theoretical estimate allowed to get the absolute density value of isotopically pure $D_2{}^{16}O$. This value was found to be $1,104 \cdot 750$ $kg \cdot m^{-3}$ at $t_{68} = 22.3°C$ and under the pressure of one atmosphere. (auth)

55 SORPTION OF MICROAMOUNT OF COLLOIDAL SILVER IODIDE ON HYDRATED IRON(III) OXIDE. Kepak, F.; Nova, I. (Nuclear Research Inst., Rez, Czech.). Radiochem. Radioanal. Lett.; 22: No. 6, 361-366(27 Sep 1975).

Sorption of a microamount of colloidal silver iodide labelled with ^{131}I on hydrated iron (III) oxide suspension was studied. The sorption dependence upon pH, sorbent amount, and inert electrolyte concentration has revealed that sorption of silver iodide reaches no more than 63%. (auth)

Isotope Effects

Refer also to abstracts 131, 1092, 1357, 1824, and 1864.

56 ROLE OF QUANTUM STATISTICS IN ISOTOPE EFFECTS IN LOW-TEMPERATURE ADSORPTION. Parbusin, V. S.: Malyavskii, N. I. (Moskovskij Gosudarstvennyj Univ. (USSR). Kafedra Fizicheskoj Khimii). Vestn. Mosk. Univ., Ser. II. Khim.; 15: No. 5, 547-549(Sep 1974). (In Russian).

For English translation see the journal Mosc. Univ. Chem. Bull.

Adsorption of helium isotopes on synthetic zeolite, NaX, at 4 to 20°K was studied, the 16 and 20°K adsorption isotherms being measured over a wide range of loading. At these two temperatures the ratio of equilibrium pressures of ^3He and ^4He, at the same adsorption values (or selectivity coefficient α), increased with increase in loading for small and average values of the latter. The behavior of α differed from its slow change ordinarily observed with increase in loading. It is suggested that the reasons for its anomalous increase are the quantum statistical effects which do not show up qualitatively on the adsorption isotherm of individual substances. From the gas-adsorbate equilibrium, assuming ideality and nondegeneracy of the gas and the absence of interaction between adsorbed particles, the ratio of initial equilibrium pressure to the Boltzman constant was calculated using values corresponding to light and heavy isotopes and a coefficient of selectivity within the limits of infinitely small adsorption. If the heavy isotope is a boson and the light is a fermion (as in the case of helium), α increases with increase in loading. The described effects make it possible to observe quantum statistical properties of particles at temperatures much higher than has been possible in the study of individual substances. (tr-INIS)

57 CALCULATION OF THE VIBRATIONAL FREQUENCIES OF ALL ISOTOPIC $WOCl_4$ MOLECULES. Brockner, W. (Technische Univ. Clausthal, Clausthal-Zellerfeld (F. R. Germany). Anorganisch-Chemisches Inst.); Hovdan, H. (Trondheim Univ. (Norway). Norges Laererhoegskole). Monatsh. Chem.; 105: No. 4, 750-754(Jul 1974).

The vibrational frequencies of the isotopic $WOCl_4$ molecules were calculated. Their correlations, the isotopic shifts and splittings, respectively, are presented and the results compared with those of $VOCl_3$. (auth)

58 INTERMOLECULAR CONTRIBUTIONS TO THE ISOTOPE EFFECT ON EXCITED STATE LIFETIMES: BENZENE. Tudron, F.B.; van Pruyssen, J.M.; Colson, S.D. (Sterling Chemistry Laboratory, Yale University, New Haven, Connecticut 06520). J. Chem. Phys. 63: No. 5, 2086-2089 (1 Sept 1975).

The phosphorescence lifetimes of several deuterium isotopes of benzene are measured. The lifetimes of C_6H_5D and $p\text{-}C_6H_4D_2$ are found to depend upon the orientation of the molecule in the site field for C_6D_6, $sym\text{-}C_6H_3D_3$, and borazine host crystals. This variation is measurable because the six or three possible orientations of the respective isotopic guests group into two energetically different sets of sites. Measurements of the lifetimes of each component of the resulting spectral doublets show an orientational difference in their lifetimes that is a significant

fraction of the difference between the lifetimes of C_6H_6 and C_6D_6 in the borazine and, presumably, the benzene host crystals. In fact, the lifetimes of C_6H_6, C_6H_5D, p-$C_6H_4D_2$, sym-$C_6H_3D_3$, and C_6D_6 in borazine can all be fit by a model which assumes that the isotope effect is entirely of *intermolecular* origin. It was found that one orientation gave a much larger isotope effect than the other. None of the existing theoretical models for interpreting isotope effects on excited state lifetimes is consistent with these data. Thus, much of the work on benzene which attempts to interpret changes in the phosphorescence decay rates in terms of basically *intramolecular* theoretical models must be reconsidered. Arguments are given which suggest that at least part, if not all, of the isotope effect observed in the benzene and borazine hosts is in the radiative decay channel. (auth)

59 ANHARMONIC FORCE FIELD OF NCO^- ISOLATED IN KI. Smith, D.F. Jr. (Science Research Laboratory, United States Military Academy, West Point, New York 10996). J. Chem. Phys. 63: No. 5, 2256-2257 (1 Sept 1975).

The anharmonic force field of NCO^- in a KI lattice has been recalculated using weighted data (instead of assuming unit weights). The new set of force constants was in much better agreement with force constants for NCO^- in other lattices. It is concluded that high correlations between the quadratic force constants can cause errors in lattice calculations and a procedure is given to avoid this problem. (AIP)

60 COMMENT ON "INTERMOLECULAR ENERGY TRANSFER IN LIQUID BENZENE: RAMAN SPECTRA, LINEWIDTH MEASUREMENTS, PICOSECOND SPECTROSCOPY, AND VIBRATIONAL RELAXATION TIMES". Laubereau, A. (Physik-Department der Technischen Universität München, München, Germany). J. Chem. Phys. 63: No. 5, 2260-2261 (1 Sept 1975).

Several comments are made to a recent paper by Griffiths, Clerc and Rentzepis. It is questioned that the picosecond technique applied in this paper provides information on the lifetime of the upper vibrational state. (AIP)

61 REPLY TO COMMENT BY A. LAUBEREAU ON "INTERMOLECULAR ENERGY TRANSFER IN LIQUID BENZENE: RAMAN SPECTRA, LINEWIDTH MEASUREMENTS, PICOSECOND SPECTROSCOPY, AND VIBRATIONAL RELAXATION TIMES". Griffiths, J.E.; Clerc, M.; Rentzepis, P.M. (Bell Laboratories, Murray Hill, New Jersey 07974). J. Chem. Phys. 63: No. 5, 2262-2263 (1 Sept 1975).

A reply is made to the preceeding Comment by Laubereau and the picosecond technique is clarified. (AIP)

62 VIBRATIONAL RELAXATION OF DF BY He AND Ar. Bott, J.F. (The Aerospace Corporation, El Segundo, California 90245). J. Chem. Phys. 63: No. 5, 2253-2254 (1 Sept 1975).

Relaxation times of DF in Ar near 1000 °K and of DF in He between 1000 and 2600 °K have been obtained in a shock tube experiment and the results have been compared with other results and calculations. It is concluded that both rotation and translation must be included in a proper description of the relaxation process. (AIP)

63 PHOTOPHYSICS OF C^-_2 ($B\,^2\Sigma^+_u$) IN RARE GAS LATTICES: VIBRATIONAL RELAXATION THROUGH INTERMEDIATE $a\,^4\Sigma^+_u$ LEVELS. Bondybey, V.E.; Brus, L.E. (Bell Laboratories, Murray Hill, New Jersey 07974). J. Chem. Phys. 63: No. 5, 2223-2231 (1 Sept 1975).

Time and wavelength resolved fluorescence techniques are used to investigate C^-_2 ($B\,^2\Sigma$) radiationless transitions following pulsed, tunable laser excitation. The purely radiative lifetimes in each host are Ne, $\simeq$64 nsec; Ar, $\simeq$40 nsec; Kr, $\simeq$38 nsec; and Xe, $\simeq$34 nsec. The principal $B\,^2\Sigma$ vibrational relaxation mechanism is a sequential process: crossing into $a\,^4\Sigma$, vibrational relaxation within $^4\Sigma$, and reverse crossing into $B\,^2\Sigma$. The observed intermediate lifetimes strongly suggest that $v=0$ $^4\Sigma$ lies between $v=0$ and 1 of $B\,^2\Sigma$; this fact allows assignment of gas phase $B\,^2\Sigma$—$a\,^4\Sigma$ rotational perturbations reported by Herzberg and Lagerqvist. The unperturbed $a\,^4\Sigma$ constants are $T_e=19\,448.4$ cm^{-1}, $\omega_e=1074.04$ cm^{-1}, $B_e=1.1348$ cm^{-1}, $\omega_e x_e=24.68$ cm^{-1}, and $\alpha_e=0.0035$ cm^{-1}. Vibrational relaxation within $a\,^4\Sigma$, and intersystem crossing, show a strong multiphonon relaxation energy gap law. The variation in behavior among the 12-12, 12-13, and 13-13 isotopes indicates that the photophysics is dominated by accidental near degeneracies with $A\,^2\Pi$ (and probably $X\,^2\Sigma$) levels in addition to $^4\Sigma$ levels. (auth)

64 VIBRATIONAL DEACTIVATION OF HF($v=1$) AND DF($v=1$) BY H AND D ATOMS. Heidner, R.F. III; Bott, J.F. (The Aerospace Corporation, El Segundo, California 90245). J. Chem. Phys. 63: No. 5, 1810-1817 (1 Sept 1975).

The deactivation of HF($v=1$) and DF($v=1$) by H and D atoms was studied at 295 K by means of the techniques of laser-induced infrared fluorescence and isothermal calorimetry. The upper limits for the deduced rate coefficients are well-defined, but the lower limits are imprecise. The results of this study are compared with other experimental data and with trajectory calculations. Qualitative data are presented regarding the role of reactive, i.e., F-atom exchange, versus nonreactive collisions in the removal of the $v=1$ level. A verification of the method was made by determining a rate coefficient for $H+HCl(v=1)$ that is in good agreement with a recent study. (auth)

65 PYROELECTRIC EFFECT IN $LiH_3(SeO_3)_2$ AND $LiD_3(SeO_3)_2$ CRYSTALS. Pel'ts, S. D.; Shuvalov, L. A.; Ivanov, N. R.; Chingina, Yu. A. Sov. Phys.-Crystallogr.; 19: No. 1, 75-79(1974).

Translated from Kristallografiya; 19: No. 1, 130-137(1974).

The characteristics of the pyroelectric effect in crystals belonging to class m are discussed. The pyroelectric coefficient vector was measured by a quasistatic method over a wide temperature range. The temperature dependence of the spontaneous polarization was calculated. Questions concerning the practical application of the pyroeffect in the $LiH_3(SeO_3)_2$ and $LiD_3(SeO_3)_2$ crystals are touched upon. (auth)

66 NMR SPECTROSCOPIC STUDY OF THE $^{10}B/^{11}B$ RATIO. Walker, J. M. (Kansas State Coll., Pittsburg); Smith, R. M.; Starks, P. J. pp 32-43 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The isotopic ratio $^{10}B/^{11}B$ was investigated by NMR spectroscopy. Sodium boride prepared either from boric acid or boron oxide was used in the study. The samples studied contained an excess of ^{10}B of approximately 20, 41, 56, 71, and 90%. (tr-auth)

67 SEARCH FOR ISOTOPE EFFECTS IN HEAVY-ION DIFFUSION IN LIQUIDS. Mills, R. (Australian National Univ., Canberra). Nature (London); 256: No. 5519, 638-639(21 Aug 1975).

Reference is made to Miller [Nature 243, 32 (1973)] who found that UO_2^{2+} ions diffusing in aqueous solution showed an isotope effect, and also that heavier ions diffuse faster than lighter ions. Miller attributed this to kinetic effects in the molecular diffusion process. The effects should apply generally to heavy ions diffusing in light solvents, and it was thought that the difference in diffusion coefficients should be measurable. Experimental work is here reported designed to test this supposition. The heavy ions chosen for study were the pairs $^{125}I^-$—$^{131}I^-$ and $^{134}Cs^+$—$^{137}Cs^+$, and diffusion coefficients for these ions were measured using the magnetically stirred diaphragm cell method. Conditions varied were temperature, concentration, and type of diffusion. Results are tabulated and show no detectable isotope effect under a variety of conditions. (UK)

68 INFRARED AND RAMAN SPECTROSCOPIC STUDIES ON THE HYDROGEN- AND DEUTERIUM-BRIDGE ASSOCIATION OF 2,2,2-TRICHLOROETHYLAMINE. Chiu, H. S. Heidelberg; Heidelberg Univ. (1973). 178p. (In German). INIS.

Thesis.

Within the framework of infrared spectroscopic investigations of differently substituted ethylamine, the effect of chlorine substitution on the hydrogen and deuterium bridge association was investigated by the example of 2,2,2-trichloroethylamine. The infrared gas spectrum (4,000 to 500 cm^{-1}) and the Raman liquid spectrum (3,500 to 50 cm^{-1}) of the pure compound and the N-dideutero compound were registered at room temperature. All bands appearing in the spectra were assigned; with the exception of the NH_2- and ND_2- torsional wave, all basic waves were handled. The infrared spectra of the liquid compound and of the binary and ternary solutions were recorded in the region of the NH_2-stretching frequencies at temperatures between +20 and −100°C. (GE)

69 INFRARED STUDY OF THE NATURE OF THE COPPER ION–ALKYNE BOND IN Y ZEOLITE. Pichat, P. (CNRS, Villeurbanne, France). J. Phys. Chem.; 79: No. 20, 2127-2129(25 Sep 1975).

The infrared spectra of acetylene, deuterated acetylene, propyne, and but-2-yne, chemisorbed in Cu, Na–Y zeolites, which have undergone various treatments, were studied. It is concluded that the OH groups interact only with the weakly absorbed molecules, the Cu^+ ions are not involved, the acetylenic hydrogen atoms do not take part in the bonding, the Cu^{2+} ion–alkyne bone results mainly from pi donation from the unsaturated hydrocarbon to the metallic ion. (auth)

70 SOLVENT ISOTOPE EFFECTS IN THE H_2O–D_2O–NaCl SYSTEM: ENTHALPIES AND FREE ENERGIES OF SOLUTION. Craft, Q. D. Knoxville, TN; Univ. of Tennessee (1975). 115p. University Microfilms Order No. 75-18,952.

Thesis (Ph. D.).

The solvent isotope effects in sodium chloride solutions of normal (H_2O) and heavy (D_2O) water (especially at low concen-

tration) were investigated. Freezing point depressions in normal and heavy water are reported from approximately 0,01 to approximately 2 m. A new value of the heat of fusion of D_2O (-1507 ± 3 cal $mole^{-1}$) was determined. Values of the partial molal enthalpies are derived from differential heats of solution of sodium chloride in both isotopic waters from 0,01 to 4 m and from 5 to 40°. The freezing point data are used to obtain osmotic coefficients at the freezing points of the solutions (H_2O and D_2O), and the enthalpy data allow calculation of the osmotic coefficient at temperatures up to 40°. The present data establish the sodium chloride–D_2O system as an isopiestic reference for future measurements on solutions using D_2O as solvent. The isotope effect on the relative partial molal enthalpy of the sodium chloride and on the osmotic coefficient shows a root m concentration dependence within experimental error. (Diss. Abstr. Int., B)

71 LOW TEMPERATURE HEAT CAPACITIES OF C_2H_6, C_2H_5D AND DIMETHYLACETYLENE. Podoll, R. T. University Park, PA; Pennsylvania State Univ. (1974). 188p. University Microfilms Order No. 75-19,803.

Thesis (Ph. D.).

The experimental and theoretical basis for expecting a Schottky type anomaly in the low-temperature heat capacities of C_2H_6 and C_2H_5D was explained. The construction and modifications of the cryostat necessary to cool the calorimetric samples to 1.0°K were then discussed in detail. The experimental data were presented, and an estimate of the lattice contribution to the heat capacities of C_2H_6 and C_2H_5D was calculated using the lattice dynamical theory of Born and von Karman. The total heat capacity of ethane below 20°K was found to be due to lattice contributions alone. This indicated that the molecules in the crystal were in their lowest lying A and E librational levels at 20°K and that transitions involving nuclear spin conversion between these levels do not appear in the heat capacities above 1.0°K. C_2H_5D, on the other hand, showed what appeared to be the beginning of a Schottky type anomaly below 4°K. This anomaly was assumed to be due to the transitions between the ground state E and A librational levels. The heat capacity of dimethylacetylene was also measured from 1.5° to 20°K and was found to be due to lattice contributions alone. Like ethane, this indicated that transitions between the ground state E and A levels do not show up in the heat capacity due to a slow rate of spin conversion. (Diss. Abstr. Int., B)

72 QUANTUM MECHANICAL FOUNDATIONS OF ISOTOPE CHEMISTRY. Bigeleisen, J. (Univ. of Rochester, NY). pp 1-28 of Isotopes and Chemical Principles. New York; American Chemical Society (1975).

The fundamental principles of isotope chemistry are developed along historical lines. Stern–Lindemann formulation of vapor pressure isotope effect, Urey–Rittenberg formulation of isotope exchange equilibria, reduced partition function ratio of Bigeleisen and Mayer, and isotope chemistry and molecular forces are discussed. (LK)

73 SECONDARY DEUTERIUM ISOTOPE EFFECTS AND THE CONFORMATION OF TRANSITION STATES IN THE SOLVOLYSES OF 3 ALPHA- AND 3 BETA-CHOLESTANYL BROSYLATES. Tarle, M.; Borcic, S.; Sunko, D. E. (Rugjer Boskovic Inst., Zagreb). J. Org. Chem.; 40: No. 20, 2949-2953(3 Oct 1975).

Secondary deuterium isotope effects in ethanolysis of 3 beta-cholestanyl-3-d_1 brosylate (2e), 3 alpha-cholestanyl-3-d_1 brosylate (2a), 3 beta-cholestanyl-2,2,4,4-d_4 brosylate (3e), 3 alpha-cholestanyl-2,2,4,4-d_4 brosylate (3a), 3 beta-cholestanyl-2 alpha-d_1 brosylate (4e), 3 alpha-cholestanyl-2 alpha-d_1 brosylate (4a), and 3 alpha-cholestanyl-2 beta-d_1 brosylate (5a) were measured. The solvolysis products of unlabeled epimeric brosylates (1e and 1a) were also determined. The deuterium content analyses of olefinic fraction obtained in acetolyses of 3e, 3a, 4a, and 5a were carried out. The magnitude of the beta isotope effects obtained in solvolysis of 3e (k/sub H//k/sub D/ equals 1.30), 4e (k/sub H//k/sub D/ equals 0.95), and 6e (k/sub H//k/sub D/ equals 1.18) leads to the conclusion that the 3 beta-cholestanyl arensulfonates solvolyze via a chair-like rate-determining transition state. On the other hand, the solvolysis products indicate a half-chair conformation for a product-forming transition state. The isotope effects measured on axial derivatives 3a (k/sub H//k/sub D/ equals 2.30), 4a (k/sub H//k/sub D/ equals 1.13), and 5a (k/sub H//k/sub D/ equals 1.60) discussed together with acetolysis products and the deuterium content of olefins products from 3a, 4a, and 5a suggest a partitioning between k/sub DELTA/ and k/sub s/ processes. (auth)

74 SECONDARY DEUTERIUM ISOTOPE EFFECTS AS A SENSITIVE PROBE FOR DOUBLE BOND PARTICIPATION. The Structure of the Cholesteryl Cation. Tarle, M.; Borcic, S.; Sunko, D. E. (Rugjer Boskovic Inst., Zagreb). J. Org. Chem.; 40: No. 20, 2954-2956(3 Oct 1975).

Kinetic analysis of the solvolysis of cholesteryl p-toluenesulfonate has led to previously published proposals on the structure of the intermediate resonance-stabilized homoallylic cation. Both symmetrical and unsymmetrical intermediates have been suggested. Results of this study, based on secondary deuterium isotope effect measurements, gave evidence in favor of the unsymmetrical structure. Data on deuterium isotope effects in the solvolysis of cholesteryl tosylates and cholestanyl brosylates in ethanol are given. (JGB)

75 VIBRATIONAL SPECTRA AND ASSIGNMENTS FOR CIS- AND TRANS-1,2-DIFLUOROCYCLOPROPANE AND THREE DEUTERIUM SUBSTITUTED MODIFICATIONS OF EACH ISOMER. Craig, N. C.; Hu Chao, T. N.; Cuellar, E.; Hendriksen, D. E.; Koepke, J. W. (Oberlin Coll., OH). J. Phys. Chem.; 79: No. 21, 2270-2282(9 Oct 1975).

Infrared spectra under a variety of experimental conditions and Raman spectra for the liquid phase have been recorded for the cis and trans isomers of 1,2-difluorocyclopropane and the 1,2-d_2, 3,3-d_2, and d_4 deuterated modifications. Almost all of the 168 fundamentals of this set of eight molecules have been observed and assigned convincingly. For cis-1,2-difluorocyclopropane-d_0 the fundamentals are (a') 3105, 3063, 3023, 1450, 1365, 1224, 1135, 1047, 862, 784, 468, 209 cm^{-1}; (a") 3055, 1346, 1150, 1089, 1060, 993, 739, 621, 319 cm^{-1}. For trans-1,2-difluorocyclopropane-d_0 the fundamentals are (a) 3070, 3021, 1457, 1380, 1203, 1132, 1068, 961, 842, 415, 279 cm^{-1}; (b) 3110, 3070, 1304, 1161, 1072, 1005, 937, 783, 452, 303 cm^{-1}. Only the 1089-cm^{-1} mode in the cis and the 937-cm^{-1} mode in the trans are in doubt. Group frequency descriptions are discussed qualitatively, and attention is drawn to the fundamentals near 1450 cm^{-1} which are characteristic of fluorocyclopropanes and appear to be largely due to ring stretching. From previously published equilibrium data for the cis-to-trans isomerization and the fundamental frequencies of the two isomers, an electronic energy difference of -2800 ± 200 cal/mol has been calculated. In contrast, the trans isomer of 1,2-difluoroethylene has an energy 1100 cal/mol greater than the cis, and the trans rotamer of 1,2-difluoroethane has an energy about 600 cal/mol greater than the gauche. (auth)

76 SPIN–LATTICE RELAXATION AND HYDROGEN BONDING IN METHANOL–SOLVENT MIXTURES. Inlow, R. O.; Joesten, M. D.; Van Wazer, J. R. (Vanderbilt Univ., Nashville). J. Phys. Chem.; 79: No. 21, 2307-2312(9 Oct 1975).

Nuclear spin-lattice relaxation times, T_1, of the hydrogen nuclei in CD_3OH and CH_3OH have been measured as a function of concentration in solvents of varying hydrogen bonding ability. CD_3OH–CCl_4, CD_3OH–$(CD_3)_2CO$, CD_3OH–CD_3OD, CD_3OH–$(CD_3)_2SO$, CH_3OH–CCl_4, and CH_3OH–$(CD_3)_2CO$ mixtures were studied over the entire range of concentration at 31°. The results show that T_1 reaches a minimum in all solvents at approximately 0.9 mole fraction alcohol. This is interpreted in terms of the structure of pure liquid methanol being disrupted by insertion of small amounts of solvent. Extrapolation of the spin–lattice relaxation time to infinite dilution, T_1^0, gives an indication of the strength of the alcohol–solvent hydrogen bond. T_1^0 is shortest in CCl_4 and increases in the order: $(CD_3)_2CO$ less than CD_3OD less than $(CD_3)_2SO$. This behavior is explained by the hindrance of rotation of the alcohol as a result of the formation of hydrogen bonds of increasing strength with the solvent. At large mole fractions of methanol, relaxation is interpreted to be a mixture of dipole–dipole and spin–rotation interaction; while in dilute solutions the spin–rotation mechanism seems to predominate. (auth)

Isotope Exchange and Isotope Separation

Refer also to abstracts 107 and 1411.

77 (BNWL-B-432) DEUTERIUM AND TRITIUM SEPARATION IN WATER BY SELECTIVE MOLECULAR EXCITATION. Whitaker, T. J.; Morrey, J. R.; Burger, L. L.; Scheele, R. D. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1975. Contract E(45-1)-1830. 27p. Dep. NTIS $4.00.

Experiments attempting to recover deuterium from an HDO sample have been performed. Many of the problems involved have been overcome, but enrichment has not yet been demonstrated. Advances in both theoretical and experimental studies, and problems still to be overcome are presented here. Selective molecular excitation is considered a viable method for the separation of deuterium and tritium from water. (auth)

78 (LA-tr-75-30) DIRECT OBSERVATION OF NON-EQUILIBRIUM EXCITATION OF HIGH VIBRATIONAL LEVELS OF THE OsO_4 MOLECULE EXCITED BY A POWERFUL CO_2 LASER PULSE AND OSMIUM ISOTOPE SEPARATION. Ambartsumian, R. V.; Gorokhov, Iu. A.; Letokhov, V. S.; Makarov, G. N. Translated by A. D. Cernicek from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 22: 96-100(1975). 9p. Dep. NTIS $4.50.

Nonequilibrium population of vibrational levels V greater than or equal to 10 was observed from the change of the vibrational structure of the ultraviolet spectrum of OsO_4 excited by a powerful CO_2 laser pulse. A 15 percent enrichment of osmium isotopes was obtained under the action of the strong infrared radiation field. (auth)

79 PROCESS FOR ENRICHING CARBON-13. Jepson, B. E. (to USAEC, Washington, D. C.). Swiss Patent Document 532948/D/. 15 Mar 1973. 4p. (In German).

A procedure is given for ^{13}C enrichment of CO_2. The CO_2 is reacted with a solvent amine solution consisting of isobutylamine and isopropanol in order to form a carbamate. The carbamate of the ^{13}C-enriched CO_2 solution is then at least partially decomposed. (tr-INIS)

80 CHEMICAL METHOD FOR THE SEPARATION OF URANIUM ISOTOPES. Laskorin, B. N.; Babenko, A. M.; Filippov, E. A.; Trubnikov, A. F. Usp. Khim.; 44: No. 5, 761-780(May 1975). (In Russian).

Published data on various methods (electrochemical, chemical, extractive, ion-exchange) for the separation of uranium-235 from uranium-238 are reviewed with emphasis on ion-exchange methods. It is pointed out that extensive research on the separation of U isotopes, with particular attention to methods involving the use of ion-exchange resins, is being conducted by Japanese scientists. A Japanese report on the enrichment of ^{235}U in an ion-exchange column with the application of an alternating electric current is mentioned. (JPRS)

81 ^1H-NMR SPECTROSCOPIC INVESTIGATIONS ON THE PROTON EXCHANGE IN SPIN SYSTEMS OF HIGHER ORDER. Limbach, H. H. Freiburg i. B.; Univ. Freiburg i. B. (1972). 78p. (In German). INIS.

Thesis.

The "direct method" to calculate the highly resolved nuclear resonance spectra, the theory of the intermolecular direct and indirect mutual exchange of nuclear spins in the magnetic nuclear resonance, the applied computer program, the cis-trans rearrangement and the association behavior of malondialdehyde-dipentadeuteroanil in carbon disulfide as well as the direct and indirect proton exchange in malondialdehyde-dipentadeuteroanil are dealt with. (auth)

82 REVISED VALUE FOR THE ^{18}O FRACTIONATION BETWEEN CO_2 AND H_2O AT 25°C. O'Neil, J. R.; Adami, L. H.; Epstein, S. J. Res. U. S. Geol. Surv.; 3: No. 5, 623-624(1975).

A new value of 1.0412 for the fractionation factor alpha between CO_2 and H_2O at 25°C is recommended on the basis of new data and a reevaluation of earlier published data. (auth)

Feed Materials Processing

Refer also to abstracts 588, 992, and 994.

Radiation Chemistry

Refer also to abstracts 36, 130, 840, 1341, and 1390–1392.

83 (AD/A-003646) RADIATION FROM HYDROGEN-ARGON MIXTURES. Physical Sciences Research Papers. Rubin, A. G.; Besse, A.; Cohn, A. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 18 Oct 1974. 18p. (AFCRL-PSRP-606; AFCRL-TR-74-0522). NTIS $3.25.

The emission of short wavelength visible light from argon-hydrogen mixtures irradiated by a pulsed 1.7-MeV electron beam was studied, as well as the absorption of 4416A radiation in the mixture. Absorption was found to increase faster than linearly with increased argon pressure. A new multipass gain or absorption measuring technique was devised which measures small amounts of gain with high sensitivity. At the highest excited state density obtained, 3×10^{13}/cc, the absorption in argon-hydrogen mixtures is positive. (GRA)

84 (AD/A-004023) ENDOR STUDIES OF RADIATION-PRODUCED TRAPPED ELECTRONS AND RADICALS. Final Report, 1 September 1971–31 August 1974. Kevan, L. (Wayne State Univ., Detroit, Mich. (USA)). 1 Nov 1974. 13p. NTIS $3.25.

ENDOR was applied to radiation-produced trapped electrons and radicals in glassy, polymer and polycrystalline disordered matrices. Abstracts of 11 publications and titles of 30 scientific talks on these topics are given. The emphasis was to develop new methods for the application of ENDOR to disordered systems. (GRA)

85 (AECL-5122) CHEMISTRY AND MATERIALS DIVISION. Progress Report, 1 January–31 March 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). May 1975. 152p. Dep. NTIS (US Sales Only) $10.75. AECL $3.00.

Progress is reported in several areas of solid state studies: ion penetration, electron microscopy, radiation damage and metal physics, nuclear methods of analysis, and nuclear chemistry. General chemistry research is reported on analysis, radioactivity measurements, and mass spectrometry and fuel analysis. Research progress in radiation chemistry, isotope chemistry, surface chemistry, ceramic studies, and metal physics is also reported. Results of studies on the strengthening of Zr alloys by combined precipitation hardening and grain size control are given. Creep of Zr single crystals is being studied, as is deuterium exchange in strongly basic systems. (JGB)

86 (AED-CONF-75-061-044) RADIATION RECYCLING PROCESS OF WASTE POLY(TETRAFLUORETHYLENE) SCRAP. Kagiya, V. T.; Hagiwara, M. (Kyoto Univ. (Japan). Faculty of Engineering). 1975. 13p. (SM–194/704). INIS.

From symposium on the use of high level radiation in waste treatment: status and prospects; Munich, F. R. Germany (17 Mar 1975).

A newly developed radiation recycling process of waste PTFE scrap to produce a fine powdery wax with molecular weight of 1×10^4 to 1×10^5 is described. PTFE waste scrap is decontaminated and irradiated with γ-rays up to 5-20 Mrad to room temperature. The irradiated scrap is then heated at about 250 to 300°C for 5 to 10 hrs, and easily pulverized to fine powder. Application of heat accelerates the reduction of mechanical strength by decomposition of the polymer radicals accumulated during irradiation, and stabilizes it for the use at higher temperature. The evolution of toxic fluorine containing compounds is diminished. This process has run on a commercial scale since July 1974, to provide about 0.5 ton powdery wax per month by reforming the chip or filament that comes from plastic operation such as perforation and cutting. (GE)

87 (ORO-2968-99) RESEARCH CONCERNING IONIC AND FREE RADICAL REACTIONS IN RADIATION CHEMISTRY. Progress Report, September 15, 1974–September 15, 1975. Williams, T. F. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 1975. Contract AT(40-1)-2968. 128p. Dep. NTIS $9.50.

The following papers accepted for publication are presented in their entirety: Ligand Electronegativity Effect on the Spin Distribution in Phosphoranyl Radicals; Mercury-201 Quadrupole Interaction in the Electron Spin Resonance of the CH_2HgCl Radical; Electron Spin Resonance Spectra of F_2NO and F_3NO^-: A Hypervalent Radical from First-Row Elements; Detection of Thiyl Radicals by Spin Trapping in the Radiolysis of Liquids; Electron Spin Resonance Studies of gamma-Irradiated Phosphite and Phosphate Esters: Identification of Phosphinyl, Phosphonyl, Phosphoranyl, and Phosphine Dimer Cation Radicals; and Electron Spin Resonance Studies of gamma-Irradiated Phosphorus Compounds Containing Phosphorus-Chlorine Bonds. Abstracts of reports published during the year are included. (LK)

88 (PEL-245) PREPARATION AND PROPERTIES OF ASBESTOS-CEMENT AND CEILITE POLYMER COMPOSITES. Jurriaanse, A.; Basson, R. A.; du Toit, G. S. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Jun 1975. 12p. Dep. NTIS (US Sales Only) $4.00.

Polymer composites based on asbestos-cement products were prepared by impregnation of the asbestos-cement products with suitable liquid monomers, followed by in situ polymerization of the monomers by exposure of the products to γ-radiation. Evaluation of the physical properties of the composites showed that remarkable improvements could be obtained with polymer loads between 5 and 40%. Compared with control samples, both water uptake and moisture movement in composite samples could be reduced by a factor of 10 to 30, while flexural strength could be increased by a factor of 2 to 5. (auth)

89 (RRL-3238-542) ANNUAL REPORT, OCTOBER 1, 1974–SEPTEMBER 30, 1975. (Mellon Inst. of Science, Pittsburgh (USA). Radiation Research Labs.). 10 Oct 1975. 31p. Dep. NTIS $5.00.

The status of the following research studies is reported: steady-state radiolysis-ESR studies; ESR studies of photolytically produced radicals; time resolved ESR spectroscopy; optical pulse radiolysis studies; studies on alkoxy radicals; mechanism of reaction of oxidizing radicals; pulse radiolysis studies of chloride solutions; one-electron redox potentials of radicals; liquid chromatographic examination of radiation produced products; and numerical methods for the treatment of complex reaction kinetics. (LK)

90 (SAND-75-0435) BENEFICIAL USES PROGRAM, Progress Report [for] Period Ending June 30, 1975. (Sandia

Labs., Albuquerque, N. Mex. (USA)). Sep 1975. Contract AT(29-1)-789. 80p. Dep. NTIS $5.45.

Status of the following programs is reported: waste resources utilization program; beneficial uses of radioisotopic waste program; and biomedical and environmental support programs. Three items were abstracted separately. (LK)

For abstracts of individual sections see: 91, 162, and 862.

91 (SAND-75-0435, pp 11-32) WASTE RESOURCES UTILIZATION PROGRAM. Sep 1975.

In Beneficial Uses program. Progress report [for] period ending June 30, 1975. (Sandia Labs., Albuquerque, N. Mex. (USA)).

The effectiveness of thermoradiation (simultaneous use of heat and ionizing radiation) as a treatment for ridding sewage sludge of pathogenic organisms is being studied. The feasibility of treating sewage sludge with thermoradiation to the ultimate benefit of society depends on a number of factors. For any proposed use of the sludge, the degree of thermoradiation treatment needed must be determined. This involves biological studies of major classes of organisms in sewage sludge. The cost of such a treatment versus the value of the benefits from sludge usage must be assessed. To do this realistically optimal treatment facilities must be designed, and actual sludge use assessment must be made. (LK)

92 PREPARATIVE ASPECTS OF RADIATION CHEMISTRY. Drawe, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Physikalische Chemie). Chimia (Aarau); 28: No. 11, 648-655(1974). (In German).

98 refs.

The use of ionizing radiation for commercial chemical production of compounds is discussed. Using this technique, reactions which are often impossible by conventional methods may become feasible. New results suggest that this technique can be competitive with conventional methods. In fact, the synthesis of ethylbromide is already possible on a commercial scale. It should be noted that radioactive products are not formed using this technique. (auth)

93 RADIATION TELOMERIZATION OF ETHYLENE BY ETHANOL. Dodnov, A. M.; Zagorets, P. A.; Shostenko, A. G.; Tarasova, N. P. (Moskovskij Khimiko-Tekhnologicheskij Inst. (USSR)). Tr. Mosk. Khim.-Tekhnol. Inst.; No. 74, 3-6(1973). (In Russian).

A study was made of ethylene telomerization by ethyl alcohol under gamma irradiation with Co-60. By using ionizing radiation as an initiator it is possible to expand significantly the experimentation possibilities of investigating the reaction mechanism. A presentation is given of a chromatogram of the reaction products and of the radiation yields at various ratios of initial reagents and various temperatures. The kinetics of the process were investigated. It was noted that the value of the partial constant for chain propagation for all practical purposes does not depend on the temperature. This behavior corresponds primarily to equal values of the activation energy for the growth and propagation stages of the chain reaction. The constants for propagation of the chain reaction increase somewhat with an increase in the number of polymerized monomer molecules up to a definite value n, and then remain constant. It is concluded that for alcohols the same features of a change in the partial constant for chain propagation are characteristic as for halogen alkanes, thio derivatives and others. (tr-auth)

94 A KINETICS STUDY OF THE REACTION OF OH RADICALS WITH TWO C_2 HYDROCARBONS: C_2H_4 AND C_2H_2. Davis, D.D.; Fischer, S.; Schiff, R.; Watson, R.T.; Bollinger, W. (Chemistry Department, University of Maryland, College Park, Maryland 20742). J. Chem. Phys. 63: No. 5, 1707-1712 (1 Sept 1975).

The flash photolysis-resonance fluorescence technique has been utilized to study the kinetics of hydroxyl radical reactions with ethylene and acetylene at 300 K over a wide range of experimental conditions. (1) $OH+C_2H_4 \xrightarrow{k1}$ Products (e.g., C_2H_5O), (2) $OH+C_2H_2 \xrightarrow{k2}$ Products (e.g., C_2H_2O+H). The bimolecular rate constant for Reaction (1) was observed to increase from $(2.24\text{–}5.33) \times 10^{-12}$ cm^3 molecule^{-1} sec^{-1} as the total pressure varied from (3–300) torr of helium. The rate constant for Reaction (2) was invariant with total pressure, and at 300°K its value was found to be $(1.65 \pm 0.15) \times 10^{-13}$ cm^3 molecule^{-1} · sec^{-1}. The observed pressure dependency of Reaction (1) brings the existing literature values for k_1 into close agreement. Reaction (2) has been shown to be particularly sensitive to secondary processes and this is discussed in some detail. (auth)

95 EPR AND ENDOR STUDIES OF CO_2^- CENTERS IN X- AND UV-IRRADIATED SINGLE CRYSTALS OF SODIUM FORMATE. Dalal, N.S.; McDowell, C.A.; Park, J.M. (Department of Chemistry, University of British Columbia, Vancouver, British Columbia V6T 1W5, Canada). J. Chem. Phys. 63: No. 5, 1856-1862 (1 Sept 1975).

Using ENDOR we have characterized the ^{23}Na and ^1H hyperfine structure of the CO_2^- radical ion in sodium formate single crystals. In contrast to previous studies we have detected CO_2^- in uv irradiated samples. ENDOR studies of the ^{23}Na hfs together with CNDO calculations indicate that the CO_2^- forms a tight ion pair with the nearer Na^+ cation, thus explaining the four line EPR hfs observed. Studies of the temperature and angular dependences of the magnetic resonance parameters suggest that in $NaHCO_2$ the CO_2^- radical anion is held rigidly in the lattice. Hf interactions have been resolved for four pairs of nearest neighbor protons and show considerable covalency in the $NaHCO_2$ structure, in agreement with recent SCF *ab initio* calculations on CO_2^-, which show that the unpaired electron is in a diffuse orbital. Extra so-called "forbidden" lines have been observed in the ^{23}Na ENDOR and a model of ENDOR enhancements involving cross relaxation with other paramagnetic species is discussed. (auth)

96 ESR STUDY ON THE SPATIAL DISTRIBUTION OF RADICALS TRAPPED IN THE HEAVY ION-IRRADIATED *n*-EICOSANE SINGLE CRYSTAL. Kimura, K. (The Institute of Physical and Chemical Research, Wako, Saitama 351, Japan); Ogawa, M.; Matsui, M.; Karasawa, T.; Imamura, M.; Tabata, Y.; Oshima, K. J. Chem. Phys. 63: No. 5, 1797-1802 (1 Sept 1975).

Single crystals of *n*-eicosane were subjected to the irradiation of helium, carbon, and nitrogen ions accelerated with the cyclotron, and the results were compared with those obtained by ^{60}Co γ-ray irradiation. Irradiation was carried out at 77°K. The nature and the spatial distribution of free radicals produced in the crystals were investigated by an ESR technique. The principal radical is $-CH_2\dot{C}HCH_2-$ (I) and the minor one, $CH_3\dot{C}HCH_2-$ (II); the linewidth and decay of these radicals were found to be LET-dependent. The ESR results indicate that radicals are trapped in two regions closely and sparsely; the relative distribution in the two regions is dependent on the LET of radiations used. The mean separation between the radicals trapped in the close proximity was estimated to be approximately 16 Å. (auth)

97 SOLVATION PROCESS OF THE TRAPPED ELECTRON IN POLAR LIQUIDS. Tachiya, M.; Mozumder, A. (Department of Chemistry and the Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana 46556). J. Chem. Phys. 63: No. 5, 1959-1962 (1 Sept 1975).

The solvation process of the trapped electron in polar liquids is investigated within the framework of the Tachiya–Mozumder model of pre-existing traps. The orientation of the molecular dipoles and the energy level of the electron are calculated, in a quasistationary approximation, as a function of time after the electron is localized in a pre-existing trap. An estimate of the solvation time is provided. (auth)

98 THE DELAYED ABSORPTION OF MICROWAVES DUE TO ELECTRON THERMALIZATION IN NANOSECOND PULSE IRRADIATED N_2, He, AND Ar AT ATMOSPHERIC PRESSURE. Warman, J.M.; de Haas, M.P. (Interuniversity Reactor Institute, Mekelweg 15, Delft, The Netherlands). J. Chem. Phys. 63: No. 5, 2094-2100 (1 Sept 1975).

The absorption of microwaves in pulse irradiated C_2H_6 (ethane), N_2, He, and Ar at atmospheric pressure has been investigated on a nanosecond timescale. In the case of C_2H_6, a time of less than 1 nsec following the pulse is required for the absorption signal to reach a time independent plateau value. For N_2, He, and Ar, a considerable delay in the development of the absorption signal is observed. This increase in absorption coefficient over 20, 50, and 300 nsec in the case of N_2, He, and Ar, respectively, is attributed to a time dependence of the electron collision frequency resulting from post-pulse thermalization of the electron energy. Using momentum transfer collision frequency data from swarm studies, the time dependence of the electron energy has been derived and is discussed in terms of the energy exchange rate coefficient K_u, defined by $-d\bar{u}/dt = K_u[\bar{u}-(3/2)\,kT]N$. For N_2, K_u is found to be almost independent of electron energy over the range $kT_e = 0.03\text{–}0.7$ eV and has a mean value of 1.55×10^{-11} cm^3 sec^{-1}. For He, K_u increases from 0.25×10^{-11} cm^3 sec^{-1} at $kT_e \simeq 0.03$ eV to 1.3×10^{-11} cm^3 sec^{-1} at $kT_e \simeq 1.5$ eV. The results are compared with energy exchange parameters from other sources. A further growth of absorption signal over several hundred nanoseconds in He is attributed to Penning ionization of impurities. (auth)

99 DISTORTION OF THE $(CN^-)_4$ PLANE OF $Ni(CN)_4^{3-}$ COMPLEX IN NaCl: EVIDENCE FROM EPR. Reddy, K.V.; Reddy, T.R.; Jain, S.C. (Solid State Physics Laboratory, Lucknow Road, Delhi-110007, India). J. Chem. Phys. 63: No. 5, 2255-2256 (1 Sept 1975).

The complex $Ni(CN)_4^{3-}$, which would be expected to be unstable, was produced by x and γ irradiation of NaCl crystals doped with the stable complex $Ni(CN)_4^{2-}$. The EPR spectrum of $Ni(CN)_4^{2-}$ was observed and its temperature dependence explained in terms of distortion of the complex from its square planar structure. (AIP)

100 REACTIONS OF SOLVATED ELECTRONS WITH SOLUTES AT HIGH CONCENTRATIONS. A LASER PHOTOLYSIS AND PULSE RADIOLYSIS STUDY. Bromberg, A.; Thomas, J.K. (Radiation Laboratory and Chemistry Department, University of Notre

Dame, Notre Dame, Indiana 46556). J. Chem. Phys. 63: No. 5, 2124-2130 (1 Sept 1975).

Solvated electrons were produced in several liquids by laser photoionization of aromatic solutes, and by pulse radiolysis. The yields of solvated electrons were decreased by high concentrations (0.1–1.0*M*) of phenol, benzene, and ethyl acetate; the effectiveness of the solutes in reducing the e^-_s yields was greater in the photolysis experiments than in the corresponding pulse radiolysis experiments. The data were, however, identical with light of wavelength 3471 or 2650 Å, from ruby and neodymium lasers, respectively. The data are used to discuss several theories. Solvated electrons in alcohols were photobleached with red light (λ=6942 Å) giving H atoms. The quantum yield for the process was found to be low. (auth)

101 HYPERFINE COUPLINGS IN PRIMARY RADIATION PRODUCTS. Box, H.C.; Freund, H.G.; Lilga, K.T.; Budzinski, E.E. (Biophysics Department, Roswell Park Memorial Institute, Buffalo, New York 14263). J. Chem. Phys. 63: No. 5, 2059-2063 (1 Sept 1975).

The characteristics of proton couplings in primary radiation products in irradiated protein and nucleic acid constituents are described. The range of β proton couplings in carboxylic acid anions is shown to be much smaller than for typical β couplings in π-electron radicals. A close correlation between σ proton coupling tensors in conjugated oxidation and reduction products and principal axes derived from crystal structure is demonstrated. Proton hyperfine coupling tensors in the primary oxidation product of aminoisobutyric acid and the ^{13}C hyperfine coupling tensor in the primary reduction product are reported. (auth)

102 BEHAVIOR OF FLUOROELASTOMERS UNDER γ-IRRADIATION. Makhlis, F. A.; Kryukova, A.; Treshchalov, V. I.; Kuz'minskii, A. S. Sov. J. At. Energy (Engl. Transl.); 33: No. 6, 1154(Dec 1972).

Translated from At. Energ.; 33: No. 6, 988(Dec 1972).

A comparative study was conducted of the processes of radiative cross-linking and degradation of fluoroelastomers and their vulcanizates in the free and stressed states in air and in a vacuum, as well as of the changes in properties as the rubber was aged. Copolymers of vinylidene fluoride with hexafluoropropylene (SKF-26), trifluorochloroethylene (SKF-32), and perfluoroalkylvinyl ether (SKF-1) were used. Values of G_c, the radiochemical yield of the network chains (the cross-linking), and G_d, the degradation coefficient, as determined by measuring the solubility and equilibrium swelling in acetone are given. (auth)

103 TREATMENT OF WASTE WATERS BY RADIATION AND BIOCHEMICAL METHODS. Makarochkina, L. M.; Mikhailova, A. K.; Gershenovich, A. I.; Filippov, M. T.; Dzhagatspanyan, R. V. Int. Chem. Eng.; 15: No. 3, 526-529(Jul 1975).

Experimental study shows that a biologically non-degradable synthetic surface-active substance (Nekal detergent) can be decomposed by exposure to high-energy radiation followed by biochemical oxidation. (auth)

104 EFFECT OF THE CONDITIONS FOR SAMPLE PREPARATION ON THE RADIOTHERMOLUMINESCENCE CURVES OF POLYETHYLENE. Mukhamedov, G. I.; Aulov, V. A.; Zubov, Yu. A.; Slovozhotova, N. A.; Bakeev, N. F. (Scientific-Research Physical-Chemical Inst., Moscow). Vysokomol. Soedin., Ser. B; 17: No. 2, 130-132(Feb 1975). (In Russian).

Three samples of polyethylene films were prepared under different conditions of pressure and temperature and stored at room temperature. They were irradiated to a dose of 0.1 Mrad. The radiothermoluminescence curves were measured 30 min, 2 hr, and 20 hr after preparation. The results clearly show that the method of preparation and length of storage clearly affect the form of the curves and can alter both the position and intensity of the maxima. (JSR)

105 RADIATION CHEMISTRY OF URACIL. Shragge, P. C. Toronto; Univ. of Toronto (1973). vp. National Library of Canada, Ottawa.

Thesis (Ph. D.).

The mechanisms of the radiolysis of uracil in aqueous solution were studied in order to provide background knowledge which may aid in the understanding of more complex chemical and biological systems. In order to understand the radiation chemistry of uracil, it has been necessary to study both the short-lived (microsecond) intermediate species and also the final products formed by the action of ionizing radiation. The technique of pulse radiolysis was used to measure the absorption spectra of these adducts, and it was determined that both the hydroxyl radical adduct and the hydrated electron adduct undergo acid-base dissociations with pK_a's of approximately 7. These adducts react with themselves and each other to form further species. The G-value for the destruction of uracil in solution was measured under carefully controlled conditions. In the presence of N_2O, this G-value varies from 4.6 at pH 5 to 1.5 at pH 9. In both cases, a plot of the G-value against pH follows a titration curve with a pK_a of approximately 7. Two classes of stable products isolated were monomeric products and dimers. The first class of products includes uracil glycols, uracil hydrates, and dihydrouracil. The dimeric products have a variety of structures, but they all consist of two saturated pyrimidine rings joined by a single bond. The yield of dimers is more pH dependent than the yields of the monomeric products; however, the dimers are the major products under all conditions studied. A mechanism is presented which explains how the different types of products arise by reactions of the transient uracil adducts with themselves and with each other, and how the state of dissociation of the transient uracil adducts causes the observed pH dependence of the G-values. (Diss. Abstr. Int., B)

106 MIGRATION POSSIBILITIES OF CHLORIDE IONS IN ALKANE MATRICES. Ceulemans, J. (Dept. of Chemistry, Heverlee, Belgium). Radiochem. Radioanal. Lett.; 22: No. 6, 379-384(27 Sep 1975).

Gamma-irradiated samples of carbon tetrachloride in alkane matrices at 77°K exhibit an optical absorption, which may be analyzed by selective bleaching. The absorption consists of two bands, which occur at about 350 nm and 470 nm and which have been assigned to CCl_4^+ and to a charge transfer complex $CCl_4.Cl$, formed by neutralization of CCl_4^+ ions by chloride ions. The much greater importance of the 470 nm band in glassy than in polycrystalline alkane matrices constitutes evidence that migration of chloride ions occurs to a much larger extent in (soft) glasses than in polycrystalline materials. (auth)

107 GAMMA IRRADIATION INDUCED ISOTOPE EXCHANGE IN NITROGEN SENSITIZED BY HELIUM, NEON, AND ARGON. Wood, C. J.; Mascall, R. A. (Central Electricity Generating Board, Berkeley, Eng.). J. Chem. Soc., A; 71: 1678-1688(1975).

Irradiated inert gases may transfer absorbed energy to nitrogen, resulting in the production of excited nitrogen molecules, ions and N atoms. These processes may promote nitriding of fast reactor components if the cover gas contains nitrogen impurity. This paper describes an investigation of energy transfer to nitrogen from helium, neon and argon. The efficiency of N atom formation was determined by ^{60}Co gamma irradiation of rare gases containing $^{14}N^{14}N$ and $^{15}N^{15}N$, with measurement of the product $^{14}N^{15}N$ by mass spectrometry. The results are correlated with the energy levels of the states produced on irradiation of the rare gases. Helium ions and metastable atoms are very efficient at producing N atoms by energy transfer to nitrogen. The helium ions have sufficient energy to produce N^+, N_2^+ and excited N_2^+ ions, resulting in increased N atom formation. Neon ions and metastables give N_2^+ ions but not the higher ionic states. In the argon system, only Ar^+ gives efficient production of N atoms. N atoms are not produced in low concentrations of nitrogen in argon. Sodium vapor caused no enhancement of N atom formation in argon, and it is concluded that N atoms would not be produced in a fast reactor cover gas if argon is used, but will be formed in a helium cover gas. (auth)

108 XENON-SENSITIZED RADIOLYSIS OF HYDROGEN SULPHIDE IN THE PRESENCE OF HBr, N_2O, CCl_4, and SF_6. Forys, M. (University Teachers Coll., Siedlce, Poland). Radiat. Eff.; 25: No. 2, 111-117(1975).

The γ radiolysis of hydrogen sulfide in the excess of xenon was studied as a function of added HBr, N_2O, CCl_4 and SF_6. Addition of HBr results in the considerable increase of H_2 yield while addition of excess of N_2O, CCl_4 and SF_6 reduces $G(H_2)$ to almost zero. When N_2O is present, the N_2 yield also varies with the H_2S/N_2O ratio, being uninfluenced by the addition of small amounts of SF_6. Consideration of possible ionic and nonionic reactions leads to the conclusion that hot hydrogen atoms play a major role in the formation both of hydrogen and nitrogen. The mechanism of electron attachment and ion recombination processes is proposed which is consistent with all the obtained data. (auth)

109 GAMMA-RADIOLYSIS OF FERRIC ETHYLENEDIAMINE TETRA-ACETATE IN NEUTRAL AQUEOUS SOLUTION. Kundu, K. P.; Matsuura, N. (Tokyo Univ.). Int. J. Radiat. Phys. Chem.; 7: No. 4, 565-571(Aug 1975).

Neutral aqueous solutions of ferric ethylenediamine tetra-acetate (F) were irradiated by ^{60}Co gamma rays and the radiolytic yields of its decomposition were determined. Formaldehyde and ferrous ions were also determined among the radiolytic products. It has been concluded that though e^-_{aq} attacks F at the central metal ion, H and OH attack the ligand of the complex. A reaction mechanism for the radiolytic degradation of the complex in neutral aqueous solution is described. The effect of methanol on the course of radiolysis was studied, and the rate of the OH + F reaction was found to be 5.2×10^8 dm^3 mol^{-1} s^{-1}. (auth)

110 SHOCK WAVES IN PULSE RADIOLYSIS OF LIQUIDS: ORIGIN, EFFECT, and SUPPRESSION OF THE OPTICAL DISTURBANCE. Hurni, B.; Bruehlman, U.; Buehler, R. E. (Eidgen-

oessische Technische Hochschule, Zurich). Int. J. Radiat. Phys. Chem.; 7: No. 4, 499-506(Aug 1975).

The origin and effects of shock waves occurring in liquid pulse radiolysis are deduced both from a detailed analysis of the optical disturbance and from measurements using a piezo-electric pressure probe. It appears that the formation of these shock waves cannot be avoided. They are most prominent at high pulse doses in liquids of large thermal expansion coefficient, low heat capacity and low compressibility. Methods to suppress the optical effects are given. (auth)

111 γ-RADIATION DECOMPOSITION YIELDS IN DEHYDRATED AND HYDRATED AMINOBENZYLPENICILLIN, AND BASIC RADIATION CHEMICAL PROCESSES. Dziegielewski, J. O. (Wroclaw Univ., Poland). Int. J. Radiat. Phys. Chem.; 7: No. 4, 507-518(Aug 1975).

The radiation decomposition yields of aminobenzylpenicillin in the anhydrous and hydrated forms were determined. The effect of water of crystallization on the decomposition yield of the thiazolidine beta-lactam system and on the deamination of aminobenzylpenicillin was studied. On the basis of spectropolarimetric and iodometric measurements and by comparing the IR and NMR spectra of irradiated and non-irradiated samples, the most radiosensitive fragments of the penicillin molecule were detected, and the relation between total changes in aminobenzylpenicillin and those pertaining to the thiazolidine beta-lactam system was determined. On the basis of radiation-induced changes in the NMR and IR spectra of aminobenzylpenicillin and from spectroscopic studies on the radiolysis products isolated, a radiolysis pattern of solid aminobenzylpenicillin is suggested. (auth)

112 DECOMPOSITION OF SOLID OXALIC ACID BY HEAVY CHARGED PARTICLES FROM THE $^{6}Li(n,\alpha)^{3}H$ REACTION. Gal, O. S.; Radak, B. B. (Institut za Nuklearne Nauk Boris Kidric, Belgrade). Int. J. Radiat. Phys. Chem.; 7: No. 4, 584-586(Aug 1975).

The radiolysis of oxalic acid dihydrate induced by alpha and ^{3}H particles was studied in mixtures of solid oxalic acid and lithium oxalate irradiated in the graphite reflector of the RA reactor. The yields of oxalic acid decomposition, G(-ox) = 2.6, and of CO_2 formation, $G(CO_2) = 5.0$, are much lower than those for gamma rays and could not be explained by the experimental error. (auth)

113 ELECTRON CAPTURE BY PYROPHOSPHATE IONS: AN ELECTRON SPIN RESONANCE STUDY. Mishra, S. P.; Nelson, D. J.; Symons, M. C. R. (Univ. of Leicester, Eng.). Int. J. Radiat. Phys. Chem.; 7: No. 4, 581-584(Aug 1975).

Exposure of alkali metal pyrophosphates to ^{60}Co γ rays at 77°K gave centers shown by ESR spectroscopy to be electron excess species with the unpaired electron localized on one phosphorus atom. (auth)

114 PHOTOEJECTION OF ELECTRONS TRAPPED IN SOLID METHYLCYCLOHEXANE. Novikov, G. F.; Yakovlev, B. S. (Inst. of Chemical Physics, Chernogolovka, USSR). Int. J. Radiat. Phys. Chem.; 7: No. 4, 479-487(Aug 1975).

Using a combined study of the γ-induced conductivity and the photoconductivity produced in methylcyclohexane after γ-irradiation at 77°K, a quantum yield of 0.8 ± 0.4 has been estimated for the photoionization of captured electrons in the absorption band 600 to 2200 nm. Based on this result, as well as the similarity in shape of the photoconductivity spectrum and the known absorption spectrum, the optical transition in this region is attributed to the photoionization of captured electrons. Using the model of a "bubble" acting as an electron trap in a solid, non-polar hydrocarbon, the spectral dependence of the dipole transition cross section has been calculated from the localized state in a continuum. Satisfactory agreement between theory and experiment has been obtained for the position of the maximum, the absolute cross section and the width of the absorption spectrum using a close-to-experimental photoejection threshold value of 0.44 eV and a trap depth of 1.6 eV. The bubble radius corresponding to these parameters is 4 Å. (auth)

115 ELECTRON SPIN RESONANCE STUDY OF γ-IRRADIATED SINGLE CRYSTALS OF FLUORENE. Barigelletti, R. (Consiglio Nazionale delle Ricerche, Bologna); Orlandi, G.; Giro, G.; Poggi, G. J. Chem. Soc., A; 71: 1436-1439(1975).

Single crystals of fluorene, γ-irradiated at room temperature, have been studied using ESR spectroscopy and the product of irradiation identified as the fluoren-9-yl radical. The components of the hyperfine coupling tensor have been determined, and the radical was found to retain the same position as the parent molecule in the crystal lattice. (auth)

116 EFFECT OF CHERENKOV LIGHT IN THE RADIATION-INDUCED LUMINESCENCE OF AQUEOUS SOLUTIONS. Steen, H. B. (Norsk Hydros Institutt for Kreftforskning, Oslo). Int. J. Radiat. Phys. Chem.; 7: No. 4, 489-498(Aug 1975).

The yield of luminescence from indole in an equivolume mixture of glycol and water observed during irradiation with ^{60}Co γ rays is found to be considerably larger than that obtained during exposure to 220 kV x rays. The difference is attributed to the γ-induced Cherenkov light which is absorbed by the solute and thereby causes additional luminescence. Thus, about 80% of the singlet excitation in a 10^{-2} mol dm^{-3} indole solution is due to this effect. The yields of the fluorescence and phosphorescence induced by Cherenkov light are determined as a function of solute concentration. The yield of Cherenkov light in water is calculated as a function of the radiation energy for various sample sizes. The results indicate that because of this effect radiations having sufficient energy to produce Cherenkov light are not suited for studies of radiation-induced solute excitation in systems where energy transfer from the solvent does not contribute to the luminescence yield. (auth)

117 HO_2 RADICAL IN GAMMA-IRRADIATED TELLURIC ACID. Oliveira, C. M.; Alcacer, L. J. (Junta de Energia Nuclear, Sacavem, Portugal). Int. J. Radiat. Phys. Chem.; 7: No. 4, 577-579(Aug 1975).

The HO_2 radical was identified as a product of the radiolysis of telluric acid through its EPR and UV spectra. A mechanism of formation is suggested. (auth)

118 POST-IRRADIATION EFFECTS IN THE RADIOLYSIS OF CUMENE AT 77°K: THE YIELD OF LUMINESCENCE. Platzner, I.; Thomas, J. K. (Notre Dame Univ., IN). Int. J. Radiat. Phys. Chem.; 7: No. 4, 573-576(Aug 1975).

Isopropylbenzene (cumene) was irradiated in the glass form at 77°K. The post-luminescence at 77°K was measured in order to determine a yield for this event. The G-value for the number of quanta emitted per 100 eV of energy absorbed is 1.2×10^{-4}. This number is related to the yield of singlet excited states formed in the post-irradiation process. The G-value of singlet excited states is 2.7×10^{-3}/100 eV. Previous experiments show that the excited state is produced via ion-recombination. (auth)

119 RADIATION MECHANISMS. IV. Electron Spin Resonance Studies of γ-Irradiated Trichloronitrosomethane and Trichloronitromethane. Mishra, S. P. (Univ. of Leicester, Eng.); Symons, M.C.R.; Tattershall, B. W. J. Chem. Soc., A; 71: 1772-1776(1975).

Trichloronitromethane on exposure to ^{60}Co γ rays at 77°K gives NO_2 radicals by dissociative electron capture. However, in methanol glasses NO_2 is barely detectable, the predominating radical formed by electron capture being $\cdot CCl_3$. The hole center formed by this molecule is thought to be $CCl_3NO_2^+$ with the unpaired electron largely confined to oxygen. In contrast, trichloronitrosomethane gives no $\cdot CCl_3$ radicals under any conditions, the major electron capture radical being probably NO. The ESR spectrum for the hole center for this compound is characteristic of iminoxy radicals and is therefore thought to be the cation Cl_3C-NO^+. (auth)

120 INVESTIGATIONS ON THE RADIOLYSIS OF AQUEOUS SOLUTIONS OF HALOGENATED HYDROCARBONS WITH RESPECT TO THE APPLICATION AS DOSEMETER. Ludwig, K. Kiel; Kiel Univ. (1973). 50p. (In German). INIS.

Thesis.

The influence of ionizing radiation on aqueous solutions of halogenated hydrocarbons was investigated. The $CHCl_3$ system was chosen as utility dosemeter and examined in detail. The change in conductivity is used to detect the ions produced by the radiation effect. This physical type of detection has the advantage over the conventional chemical methods that the radiation effect can be directly picked up as an electrical signal. By using electronic accessories (Phase-lock-technique), the sensitivity can be considerably raised compared to chemical methods. Conductivities of 10^{-10} s/cm can easily be detected. This would correspond to a HCl concentration of 2.54×10^{-10} mol/l. Simultaneously the dose-effect curves can thus be directly plotted down with high time resolution. Special conductivity measuring cells are constructed and calibrated for the measurements. The investigations of $CHCl_3$ systems show that it is not suitable for accurate measurements as a dosemeter due to the dose value dependence of the HCL yields. By intervening in the chemical conversions occuring during radiolysis by the addition of resorcinol as a radical catcher it is possible to achieve a linearization of the effects. The influence of the resorcinol concentration, temperature and dose value are measured. The thus modified $CHCl_3$ system is suitable for use as utility dosemeter. (GE)

121 RATE FOR ENERGY TRANSFER FROM EXCITED CYCLOHEXANE TO NITROUS OXIDE IN THE LIQUID PHASE.

Wada, T.; Hatano, Y. (Tokyo Inst. of Tech., Meguro, Japan). J. Phys. Chem.; 79: No. 21, 2210-2214(9 Oct 1975).

Pure liquid cyclohexane and cyclohexane solutions of nitrous oxide have been photolyzed at 163 nm. The quantum yield of the product hydrogen in the photolysis of pure cyclohexane is found to be 1.0. The addition of nitrous oxide results in the reduction in the yield of hydrogen and in the formation of nitrogen. The decrement of the hydrogen yield is approximately equal to the increment of the nitrogen yield. About 40 percent of the hydrogen yield in pure cyclohexane is found to be produced through a path which is not affected by the addition of nitrous oxide. The effect of the addition of nitrous oxide is attributed to energy transfer from excited cyclohexane to nitrous oxide with the rate constant of k equals 1.0×10^{11} M^{-1} sec^{-1} (at 15°C). This value is about a factor of 10 larger than that expected as for diffusion-controlled rate. A contribution of the energy transfer process to the formation of nitrogen in the radiolysis of cyclohexane solutions of nitrous oxide has also been discussed. (auth)

122 PHOTOCHEMISTRY OF RADICALS TRAPPED IN FROZEN METHANOL–WATER MIXTURES. Moan, J.; Hovik, B. (Norsk Hydro's Inst. for Cancer Research, Oslo). J. Phys. Chem.; 79: No. 21, 2220-2224(9 Oct 1975).

Methanol–water mixtures were exposed to x-rays at 77°K and the photochemistry and paths of conversion of the induced radicals were investigated by ESR methods. The main x-ray induced radical, the hydroxymethyl radical, is photolyzed by uv light to give CH_3 and CHO radicals and H atoms. The CHO radicals give rise to CH_2OH and H atoms when bleached by visible light and to another radical, possibly the methoxy radical, when annealed. Uv irradiation of this radical gives back CHO radicals and CH_2OH radicals. The methyl radicals give rise to CH_2OH radicals, and possibly also CHO radicals when decaying at 77°K. The uv irradiation seems to cause photoionization of the hydroxymethyl radical. X-irradiation gives rise to somewhat different spectra in glassy and polycrystalline matrices. In the latter case a narrow (DELTA H equals 3.4 ← 0.6 G) singlet spectrum is formed which is not seen in glassy matrices. This singlet may be due to electrons in shallow traps, since it is eliminated by the presence of an electron scavenger (H_2O_2). (auth)

123 COMPETITIVE FREE-ELECTRON SCAVENGING IN LIQUID NEOPENTANE. Mori, K.; Ito, K.; Hatano, Y. (Tokyo Inst. of Tech.). J. Phys. Chem.; 79: No. 20, 2093-2095(25 Sep 1975).

The competitive free-electron scavenging of N_2O with various electron scavengers was studied in the radiolysis of liquid neopentane. The ratio of scavenging rate constant k(s) of a scavenger s to $k(N_2O)$ was determined by measuring the decreases of $G(N_2)$ upon the addition of s to neopentane solutions of N_2O. These are $k(CCl_4)/k(N_2O)$ equals 31, $k(CH_2Br)/k(N_2O)$ equals 5, $k(C_2H_5Br)/k(N_2O)$ equals 0.6, and k(biphenyl)/$k(N_2O)$ approximately equal to 0. The value of $k(CH_3I)/k(N_2O)$ apparently depends upon the concentration of CH_3I. The possibility of the negative charge transfer from N_2O^- to s has also been discussed. The result shows the scavenging rate to be largely dependent upon the scavenger s, which could not be found in cyclohexane. It seems to indicate that in liquid neopentane the free-electron scavenging process may not necessarily be explained in terms of diffusion kinetics. (auth)

124 MATRIX EFFECTS ON THE CHARGE RESONANCE ENERGY OF THE DIMER CATIONS. Low-Temperature Radiolysis of Glassy Aromatic Solutions. Buhler, R. E.; Funk, W. (Swiss Federal Inst. of Tech., Zurich). J. Phys. Chem.; 79: No. 20, 2098-2105(25 Sep 1975).

Near-infrared absorption bands due to several aromatic hydrocarbons in irradiated organic glasses were assigned to the charge resonance band of the corresponding dimer cations. The observed drastic changes of these bands with the matrix characteristics were found to correspond to the changes in the structure of the dimer cation: a hard matrix (e.g., methylcyclohexane) strongly distorts the dimer cation, thereby reducing the charge resonance energy, unless steric effects are involved (difference between benzene and tert-butylbenzene). On softening the matrix there is a continuous relaxation process with a simultaneous increase in the charge resonance energy, until the conformation of the free dimer cation is reached. It is concluded that benzene and tert-butylbenzene do form quite loose complexes, suffering large matrix effects, that the naphthalene dimer cation is a very tight complex with no matrix effects, and that bromobenzene is intermediate. Earlier published band assignments by Ekstrom for systems with benzene are reconsidered in the context of this matrix effects. For a 3MP glass with benzene and CCl_3Br the benzene dimer cation decays isothermally (77°K) into a new transient, absorbing at 740 nm. The corresponding changes in the absorptions cannot be related to a matrix effect. The new 740-nm band was tentatively assigned to a complex between the benzene cation and CCl_3Br. The decay of the bromobenzene dimer cation in 3MP leads to the formation of a new absorption at 570 nm. This is assigned to the (Br-BrPh) charge transfer complex. (auth)

125 ENERGY DEPENDENCE OF RADIATION DAMAGE IN l-VALINE. Howitt, D. G.; Glaeser, R. M.; Thomas, G. (Univ. of California, Berkeley). pp 246-247 of Thirty-Third Annual Meeting of the Electron Microscopy Society of America. Bailey, G. W. (ed.). Baton Rouge, LA; Claitor Book Store (1975).

From 33rd annual meeting of the Electron Microscopy Society of America; Las Vegas, NV (11 Aug 1975).

Values of the critical exposure for l-valine, which suffers principally ionization damage, were obtained in the 50 to 3000 keV energy range. Measurement of the critical exposure is achieved by measuring the total electron exposure sufficient to destroy the diffraction pattern of the material. Assuming that the energy required to destroy the material is directly proportional to the energy lost by this primary beam the behavior can be calculated from the equations of Bethe. Such comparisons predict an approximate $beta^2$ dependence of the critical exposure. (LK)

126 TRANSPORT OF RADIATION-INDUCED CHARGE CARRIERS IN LIQUID ALKANES. Chandrasekaran, T. College Park, MD; Univ. of Maryland (1974). 124p. University Microfilms Order No. 75-14,300.

Thesis (Ph. D.).

The transport of radiation-induced charge carriers in liquid alkanes was analyzed in zero external electric field to study the electron scavenging process and the time dependent decay of scavenger anions; the model system chosen for the study is cyclohexane containing biphenyl as the scavenger. For this purpose, Monchick's equation describing the scavenging kinetics for various scavenger concentrations, C/sub s/, was solved numerically to obtain the spatial distribution of electron cation pairs at different times and the total scavenger anion yields. Calculations were performed using the exponential, Gaussian and delta function initial distributions of the electron-cation pairs. The exponential distribution provides the best fit of calculated values over the widest range of experimental results. All three initial distributions give equivalent results for C/sub s/ less than 10^{-3} moles per liter. (LK)

Radiochemistry and Nuclear Chemistry

Refer also to abstract 85.

Hot-Atom Chemistry

Refer also to abstract 1837.

127 (COO-1713-53) STATUS OF POLYVALENT HOT ATOM CHEMISTRY. Gaspar, P. P. (Washington Univ., St. Louis, Mo. (USA). Dept. of Chemistry). 1975. 5p. (CONF-750481-1). Dep. NTIS $4.00.

From panel discussion of hot atom chemistry, its present status and future directions; Upton, New York, USA (11 Apr 1975).

The purpose of this statement is to describe the present and foreseeable future of polyvalent hot atom chemistry, to relate it to other areas of endeavor, and to justify its continued support by ERDA. (auth)

128 (JUL-1168) REACTIVITY AND SELECTIVITY OF THE ELECTROPHILE AROMATIC SUBSTITUTION IN THE GAS PHASE BY POSITIVE ^{80}Br AND ^{125}I DECAY IONS. Knust, E. J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Nuklearchemie; Koeln Univ. (F. R. Germany)). Feb 1975. 101p. (In German). INIS.

Thesis.

The nuclear isomeric transition $^{80m}Br(IT)^{80}Br$ or the electron capture decay $^{125}Xe(EC)^{125}I$ in the presence of high concentrations of a noble gas such as Ar or Xe are suitable for the study of the electrophilic substitution of bromium or iodonium ions in the gas phase. By using this nuclear method, which, unlike physical methods, also allows the determination of the isomer distribution, the electrophilic aromatic bromation and iodation of monosubstituted benzene compounds through unsolvated positive bromine or iodine ions could be investigated for the first time using radiogas chromatographic techniques. (GE)

129 (ORO-3602-16) REACTIONS OF CHARGED AND NEUTRAL RECOIL PARTICLES FOLLOWING NUCLEAR TRANSFORMATIONS. Ache, H. J. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Sep 1975. Contract AT(40-1)-3602. 35p. Dep. NTIS $5.00.

The status of the following programs is reported: study of the stereochemistry of halogen atom or ion reactions produced via (eta,gamma) or (IT) nuclear reactions with diastereomeric molecules; study of nuclear decay induced reactions of halogen species with organic compounds in the gas phase; decay-induced labelling of compounds of biochemical interest; energetics and mechanisms involved in the reactions of highly energetic carbon-11 atoms with simple organic molecules; and chemistry of the positronium. (LK)

130 INVESTIGATION ON THE ^{65}Ni-RETENTION IN THE NEUTRON IRRADIATION OF NEUTRAL NICKEL COMPLEXES IN SOLUTION. Excerpt. Ndiokwere, C. L. Darmstadt, Ger.; Technische Univ. (1972). 4p. (In German). INIS.

Thesis.

The chemical behaviour of the ^{65}Ni recoil atoms during the neutron irradiation of nickel complexes in solution was studied. The influence of concentration of the nickel complex, the solvent, addition of specific catcher substances, and irradiation time on the retention of the ^{65}Ni recoil atoms was tested. In the nuclear reaction ^{64}Ni(n,γ)^{65}Ni on neutral nickel complexes (chelate and sandwich complexes) in organic solution, a primary retention of some 4 to 6% was observed. (GE)

131 REACTIONS OF FLUORINE ATOMS WITH H_2 AND D_2. Grant, E. R. Davis, CA; Univ. of California (1974). 281p. University Microfilms Order No. 75-15,434.

Thesis (Ph. D.).

Reactions of ^{18}F atoms with H_2 and D_2 were studied under conditions of both thermal and hot atom initiation. Radiolabeled fluorine atoms were generated in situ by the irradiation of samples with fast neutrons thereby inducing the ^{19}F(n,2n)^{18}F nuclear reaction. The systems studied contained varying concentrations of H_2 or D_2, C_3F_6, and for the thermal experiments a 95 percent moderating bath of C_2F_6. The perfluoroolefin C_3F_6 served as a standard competing reactant. Yields of H^{18}F or D^{18}F were directly measured for all systems. Relative rate constants were calculated from an analysis of the sample composition dependences of these yields. By varying the ambient temperature of irradiation for moderate samples the following Arrhenius parameters were obtained for the thermal relative constants k/sub C_3F_6//k/sub H_2/ and k/sub C_3F_6//k/sub D_2/: (0.056 +- 0.002) exp [(1502 +- 17)/RT] and (0.058 +- 0.002) exp [(1884 +- 20)/RT], respectively. The following temperature dependence of the intermolecular kinetic isotope effect (k/sub H_2//k/sub D_2/) follows from these results: (1.04 +- 0.06) exp [(382 +- 35)/RT]. The temperature dependence of the unmoderated competitions, H_2 vs C_3F_6 and D_2 vs C_3F_6 were also studied. (LK)

Properties of Radioactive Materials

Refer also to abstracts 825, 1063, 1064, 1081, 1103, 1112, and 1173.

132 (CNEA-384) LABELING OF TUNG OIL WITH ^{131}I. Correia, R. J.; Mitta, A. E. A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1975. 8p. (In Spanish). Dep. NTIS (US Sales Only) $4.00.

A method for labelling Tung Oil with ^{131}I is described. The oil is dissolved in peroxide-free, dry ethyl ether and then it is treated with ^{131}ICl. A 2.5% mercuric acetate solution in glacial acetic acid is added as a catalyst. A radio-chemical yield of 100% is achieved in 20 minutes. (auth)

133 (COM-75-10052) COMPARISON OF TWO MELTING-PRESSURE EQUATIONS CONSTRAINED TO THE TRIPLE POINT USING DATA FOR ELEVEN GASES AND THREE METALS. Technical Note (Final). Goodwin, R. D.; Weber, L. A. (National Bureau of Standards, Boulder, Colo. (USA)). 6 Oct 1963. 28p. (NBS-TN-183). NTIS $3.75.

Previously announced as N-64-14291.

Parameters have been determined by a least-squares method for the reduced Simon equation and for a new, empirical melting equation using data for H_2, D_2, T_2, Ne, Ar, Kr, Xe, N_2, O_2, H_2O, Na, K, and Hg. The new equation, $(P - P(+))/(T - T(+)) = A \exp(-(\text{alpha})/T) + BT$, represents experimental data with essentially the same accuracy as the Simon equation. It provides a sensitive difference method for graphical examination of data. (GRA)

134 (EUR-5381e) EUROPEAN INSTITUTE FOR TRANSURANIUM ELEMENTS (EURATOM), KARLSRUHE. Schmidt, H. E. (comp. and ed.). (Commission of the European Communities, Luxembourg). 1975. 68p. Dep. NTIS (US Sales Only) $6.50.

The booklet was compiled to make available to the public a comprehensive description of the activities of the European Institute for Transuranium Elements of the Joint Nuclear Research Centre of EURATOM. The first part describes the objectives of the Institute, its historical and geographical background, its structure, and its operation. In the second part, an account of activities in the areas of fuel science and technology and basic actinide research is given. (JGB)

135 (KFK-tr-448) COEXISTENCE OF HAFNIUM AND SUPERHEAVY ELEMENTS IN NATURE. Maslov, O. D.; Popeko, A. G.; Skobelev, N. K.; Ter-Akop'yan, G. M. (Kernforschungszentrum Karlsruhe (F. R. Germany). Literaturabteilung). Mar 1975. 6p. (In German). INIS.

Search for superheavy elements in natural hafnium is reported. The concentration of superheavy elements was much smaller than the concentration reported in the work of Maly (1974). (GE)

136 SAMARIUM AND EUROPIUM PERTECHNETATES. Zajtseva, L. L.; Konarev, M. I.; Velichko, A. V.; Sukhikh, A. I.; Chebotarev, N. T. Zh. Neorg. Khim.; 19: No. 10, 2674-2678 (Oct 1974). (In Russian).

For English translation see the journal Russ. J. Inorg. Chem.

Samarium and europium pertechnetates were recovered and their compositions determined, expressed by the general formula $R(TcO_4)_3 \cdot 3H_2O$ (R = Sm or Eu). Thermographic and thermoradiometric analyses showed that dehydration of the initial hydrated crystals occurs in two stages, similar to the dehydration of La and Ce pertechnetates. X-ray phase analysis showed a trihydrate, a monohydrate, and an anhydrous samarium pertechnetate and corresponding europium compounds. These results were confirmed by infrared spectroscopy. (tr-auth)

137 MORPHOLOGICAL AND STRUCTURAL INVESTIGATIONS OF URANIUM CHALCOGENIDE CRYSTALS. Ehlert, G. V.; Kuz'micheva, G. M.; Eliseev, A. A.; Slovyanskikh, V. K.; Morozov, S. P. (AN SSSR, Moscow. Inst. Obshchej i Neorganicheskoj Khimii). Zh. Neorg. Khim.; 19: No. 10, 2834-2838(Oct 1974). (In Russian).

For English translation see the journal Russ. J. Inorg. Chem.

Morphological peculiarities of growth of monocrystals of B-US_2, B-USe_2, U_3S_5, UOS, and US_3 were studied, and predominant grains, classes of symmetry, and precise groups were determined. By x-ray structure studies, with computer processing of the results, the coordinates of the atoms and shapes of the coordination polyhedrons for the compounds B-US_2, B-USe_2, and UOS were determined precisely. The motif of the distribution of heavy atoms in U_3S_5 was determined first. (tr-auth)

138 ELECTROMETRIC STUDY ON THE COMPOSITION AND STABILITY OF THIOLACTIC ACID COMPLEXES WITH Zn^{2+} AND UO_2^{2+}. Saxena, R. S.; Singh, P. (Malaviya Regional Engineering Coll., Jaipur (India). Dept of Chemistry). Monatsh. Chem.; 105: No. 5, 1142-1247(Sep 1974). (In German).

The complexation of thiolactic acid with Zn^{2+} and UO_2^{2+} was investigated by potentiometric and conductometric titration techniques. Both the metals form 1 : 1 and 1 : 2 complexes in different pH ranges. Their log K_{stab} values have been determined by Calvin and Melchior's extension of Bjerrum's method and were further refined by alternative methods at temperatures 20, 30, and 40°C. The values of overall changes in ΔG, ΔH, and ΔS for complexation are also reported. (auth)

139 PREPARATION AND PROPERTIES OF THULIUM- AND YTTERBIUM PERTECHNETATES. Zajtseva, L. L.; Konarev, M. I.; Velichko, A. V.; Sukhikh, A. I.; Chebotarev, N. T. Zh. Neorg. Khim.; 19: No. 11, 2973-2977(Nov 1974). (In Russian).

For English translation see the journal Russ. J. Inorg. Chem.

By reacting pertechnic acid with thulium and ytterbium oxides the compounds $Tm(TcO_4)_3 \cdot 4H_2O$ and $Yb(TcO_4)_3 \cdot 4H_2O$ were obtained for the first time. By the method of thermal analysis a study was made of the mechanism of dehydration for the tetrahydrates of thulium and ytterbium pertechnetates. X ray phase analysis and an analysis of infrared spectra showed that the tetrahydrate, the dihydrate and the anhydrous thulium pertechnetate are isostructural with the corresponding compounds of ytterbium pertechnetate. (tr-auth)

140 INTERACTION BETWEEN OXYGEN AND POTASSIUM TETRACHLOROURANYLATE AT 20–1000°C. Vorobej, M. P.; Bevz, A. S.; Skiba, O. V. Zh. Neorg. Khim.; 19: No. 11, 3068-3070(Nov 1974). (In Russian).

For English translation see the journal Russ. J. Inorg. Chem.

By the methods of thermogravimetric, chemical and x ray phase analyses a study was made of the interaction of oxygen with $K_2UO_2Cl_4$ on heating in air to 1000°C. The heat and entropy of melting of $K_2UO_2Cl_4$ were determined. The final reaction product is potassium diuranate. (tr-SJR)

141 PREPARATION OF RADIOACTIVE NUCLEOTIDES. Nejedly, Z.; Skodova, H.; Ekl, J.; Moravek, J.; Skoda, J. Czechoslovak Patent 151315. 20 Nov 1972. 3p. (In Czech).

A method is described of enzymatic synthesis of some nucleotides, specifically or non-specifically labelled with ^{3}H or with ^{14}C. The starting substance is a non-purified supernatant fraction of the bacterial suspension of the Brevibacterium ammoniagenes, strain CCEB 364 culture. Paper chromatography is employed for the separation of the reaction product mixture. (INIS)

142 REFINEMENT OF THE CRYSTAL STRUCTURE OF CUPROSKLODOWSKITE, $Cu[(UO_2)_2(SiO_3OH)_2].6H_2O$. Rosenzweig, A. (Oberlin Coll., OH); Ryan, R. R. Am. Mineral.; 60: 448-453 (1975).

The structure of cuprosklodowskite has been refined using three dimensional x-ray techniques. The space group is P anti 1 with a equals 7.052(5), b equals 9.267(8), c equals 6.655(5) A, alpha equals 109.23°(5), beta equals 89.84°(5), gamma equals 110.01°(7), and Z equals 2. The structure consists of sheets of $[(UO_2)_2(SiO_4)_2]^{4-}$, formed by edge-sharing pentagonal-bipyramidal UO_7 groups and SiO_4 tetrahedra, separated by $[Cu(H_2O)_4]^{2+}$ ions and H_2O. The coordination polyhedron for Cu^{2+} is a tetragonal bipyramid with axial Cu-O distance of 2.48 A and an equatorial distance of 1.97 A. In the UO_7 polyhedron the axial distances are 1.77 A with equatorial distances ranging from 2.29 to 2.43 A. The three oxygen Si-O distances in the SiO_4 tetrahedron which are shared with UO_2^{2+} ions are 1.59, 1.60, and 1.61 A while the distance to the unshared oxygen atom is 1.67 A, lending support to the hypothesis that the 2 protons per formula unit, which are necessary for charge balance, are attached to the unshared silicate oxygen. The structure was found to contain one water molecule more than previously reported; the formula $Cu[(UO_2)_2(SiOH)_2] \cdot 6H_2O$ is suggested. (auth)

143 COMMENT ON "ELECTRONIC STRUCTURE OF UF_{-6}" BY M. BORING, J. H. WOOD, AND J. W. MOSKOWITZ [J. CHEM. PHYS. 61, 3800 (1974)]. Edelstein, N. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720); Karraker, D. J. Chem. Phys. 63: No. 5, 2269-2269 (1 Sept 1975).

It is pointed out that some of the data used for comparison with the calculation on the UF^{-}_{6} ion in a recent paper by Boring, Wood, and Moskowitz is generally considered incorrect. This has no effect on the calculations or the main conclusions of the original paper. (AIP)

144 REDUCTION OF PERTECHNETATE IN HYDROCHLORIC SOLUTIONS. Muenze, R.; Noll, B. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Isotopenpraxis; 11: No. 5, 190-194(May 1975). (In German).

Thin-layer chromatography on cellulose-coated plates with HCl or methanol/water as a solvent was used to investigate the reduction of TcO_4^- in solutions of ^{99}Tc and ^{99m}Tc by means of HCl, HCl/HI and $SnCl_2$ HCl. In carrier-free ^{99m}Tc solutions, unlike ^{99}Tc solutions, the reaction products do not contain technetium (V). Further differences arise with regard to the hydrolysis products. (auth)

145 TRITIUM LABELLING OF ADENINE. Roemer, J.; Kiessling, M. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Isotopenpraxis; 11: No. 4, 150-152(Apr 1975). (In German).

In order to label adenine with tritium the isotope exchange procedure in HTO with an additional radiation source, the modified Wilzbach procedure, and the catalytic dehalogenation method were used. These methods were compared. The catalytic dehalogenation method of 8-bromoadenine yielded the best results (15-20 Ci/mmol, 99% radiochemical purity). (auth)

146 COMPLEX FORMATION AND SOLVATION OF SOME ACTINIDES. I. Studies on Complex Formation with Acetate and Citrate. Nebel, D.; Anders, G. (Zentralinstitut fuer Kernforschung, Dresden). Isotopenpraxis; 11: No. 4, 152-155(Apr 1975). (In German).

Previous studies on the citrates of Th^{4+}, U^{4+}, and Pu^{4+} showed that the stability constants increase with the atomic number and the temperature. An extension of the studies to the acetates of U(IV) and Th(IV) and to plutonyl citrate had the purpose of confirming these tendencies and of determining quantitatively the expected displacement of the redox potential Pu(IV)/Pu(VI) with the complex formation. The results confirmed that the complex constants of Pu compounds were larger than those of the U compounds. Absorption spectra are given for the U(VI)-acetate, PU(IV)-acetate, and PuO_2^{2+}-citrate solutions. The redox potential of Pu(IV)/Pu(VI) in $HClO_4$ and citrate is compared with that of Pu(III)/Pu(IV) in the same solutions. (JSR)

147 COMPLEX FORMATION AND SOLVATION OF SOME ACTINIDES. II. Studies in the Dioxane/Water System. Anders, G.; Nebel, D.; Geipel, G. (Zentralinstitut fuer Kernforschung, Dresden). Isotopenpraxis; 11: No. 4, 156-158(Apr 1975). (In German).

Preliminary results are presented on the behavior of uranium and uranyl ions in dioxane-water systems. An analysis of the dioxane-water system showed that distinct dioxane-water structures are formed and that these affect the redox behavior of U and uranyl ions. This is illustrated by showing the dependence of the half-stage potential of the two ions on the dioxane concentration. (JSR)

148 GROWTH OF URANYL RUBIDIUM NITRATE SINGLE CRYSTALS FOR EXPERIMENTS WITH ORIENTED NUCLEI. Gentosh, A. I.; Gonin, N. N.; Kozlovskii, L. K.; Stavisskii, Yu. Ya.; Tambovtsev, D. I. (Physical Power Inst., Obninsk, USSR). Instrum. Exp. Tech.; 18: No. 1, 271-272(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 232-234(1975).

An apparatus for growing single crystals of uranyl rubidium nitrate several cubic centimeters in volume is described; it may also be used for depositing thin (1-3 mg/cm^2) isomorphic films of an analogous radioactive actinide compound on the crystal faces. (auth)

149 PREPARATION OF [8-^{3}H] ADENOSINE-5-TRIPHOSPHATE OF HIGH MOLAR ACTIVITY. Bohacek, L.; Filip, J. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague). Radioisotopy; 16: No. 3, 311-334(Jul 1975). (In Czech)

A synthesis of [8-^{3}H]adenosine-5'-triphosphate with a molar activity greater than 10 Ci/mmol and radiochemical purity better than 95% was developed. The catalytic reduction dehalogenation of 8-bromoadenosine-5'-triphosphate was studied and in tracer experiments it was found that highest molar activities can be obtained with the use of 1N ammonium hydroxide. The catalytic phosphorylation of [8-^{3}H]adenosine-5'-monophosphate was studied in the presence of the enzymic preparation from E. coli B. [8-^{3}H]Adenosine-5'-triphosphate was prepared with a yield of 64.4%. The dependence on pH of the isotopic exchange of hydrogen in [8-^{3}H]adenosine-5'-triphosphate in aqueous medium (100°C, 1 hour) was investigated. The isotope hydrogen exchange is significantly accelerated in alkaline media. (auth)

150 STUDY OF AgI SOL FORMATION AT HIGH DILUTION OF Ag^+ AND I^- IONS BY THE MEASUREMENT OF THE $^{110m}Ag^+$ SELF-DIFFUSION COEFFICIENT. Kepak, F.; Kriva, J. (Nuclear Research Inst., Rez, Czech.). Radiochem. Radioanal. Lett.; 22: No. 6, 367-370(27 Sep 1975).

The dependence of $^{110m}Ag^+$ self-diffusion on I^- ion concentration was used to study the formation of microamounts of silver iodide sol labelled with ^{110m}Ag in aqueous solution. The formation of silver iodide sol appeared as a decrease of the value of the self-diffusion coefficient of silver ions. Probable formation of the AgI_2^- complex led to an increase of the self-diffusion coefficient. (auth)

151 AMIDE COMPLEXES OF THORIUM(IV), URANIUM(IV), AND DIOXOURANIUM(VI) NITRATES. Bagnall, K. W.; Lopez, O. V. (Univ. of Manchester, Eng.). J. Chem. Soc. (London), Dalton Trans.; No. 14, 1409-1412(1975).

Complexes of thorium tetranitrate, $Th(NO_3)_4 \cdot xL$ (x = 3, L = MeCONHMe; x = 2.5, L = $MeCONEt_2$, $EtCONMe_2$, or $Me_2C \cdot CONMe_2$; x = 2, L = $MeCONPh_2$), uranium tetranitrate, $U(NO_3)_4 \cdot 2.5L$ (L = $MeCONEt_2$ or $EtCONMe_2$), and dioxouranium(VI) nitrate, $UO_2(NO_3)_2 \cdot 2L$ (all above $R'CONR''_2$), were prepared. Their IR, Raman, and electronic spectra are discussed. (auth)

152 PROPERTIES OF AQUEOUS THORIUM NITRATE SOLUTIONS. III. Partial Molal Heat Capacities and Heats of Dilution at 30°C. Apelblat, A.; Sahar, A. (Israel Atomic Energy Commission, Beersheba). J. Chem. Soc., A; 71: 1667-1670 (1975).

The partial molal heat capacities and heats of dilution of $Th(NO_3)_4$ at 30°C are reported and compared with values in the literature at 25°C. The effect of addition of 0.001 mol dm^{-3} HNO_3, to prevent hydrolysis, is also discussed. (auth)

153 APPLICATION OF LAGUERRE FUNCTIONS FOR APPROXIMATION AND SMOOTHING OF COUNT RATS VARYING WITH TIME. Hansson, L.; Kurten, R.; Thyn, J. (Isotoptekniska Laboratoriet, Stockholm). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 347-354(Jun 1975).

When radioisotope tracers are used for the study of continuous flow systems to determine the residence time distribution, the count rate as a function of time has to be evaluated. It is shown that the use of Laguerre functions for this evaluation provides a very powerful tool for reproducing with good accuracy the true continuous residence time distribution from sampled measurements where each measurement is subject to statistical fluctuation. At the same time the use of Laguerre functions provides the measured residence time distribution in an analytical form which makes it easy to handle mathematically. (auth)

154 WORKING OUT MICROSYNTHESES FOR DIFFERENT CHLORINATED BIPHENYLS AND PREPARATION OF 2,2'-

DICHLOROBIPHENYL-^{14}C AND 2,4'-DICHLOROBIPHENYL-^{14}C. Geuenich, H. H. Bonn; Univ. Bonn (1972). 82p. (In German). INIS.

Thesis.

The microsyntheses for the preparation of chlorinated biphenyls starting with benzene were worked out. 2,2'-dichlorobiphenyl-^{14}C and 2,4'-dichlorobiphenyl-^{14}C were prepared. 42 mCi benzene-^{14}C were converted into nitrobenzene with nitrating acid, which was reduced to aniline by tin(II) chloride/hydrochloric acid. Following the acetylation of aniline with acetic anhydride, it was monochlorated in glacial acetic acid with chloride of lime, and the chlorination mixture was chromatographically separated in columns. 5.8 mCi o'-chloroanaline was diazotized and converted in ammoniacal copper(I) salt solution. 2 μCi 2,2'-dichlorobiphenyl was obtained. (auth)

155 INFLUENCE OF THE CHEMICAL BOND ON THE INTERNAL CONVERSION OF ^{125}Te. Schule, R. Heidelberg; Univ. Heidelberg (1973). 32p. (In German). INIS.

Thesis.

The influence of the chemical binding on the internal conversion was investigated at the 35 keV M1-transition in ^{125}Te. For this, the conversion electron spectra were measured. Radioactive sources of different chemical compositions (TeO_2, ZnTe, $Na_2H_4TeO_6$) were used. The determination of the valence electron density at the nucleus is possible by calibration of the experimental electron densities with Hartree-Fock calculations. These values, together with results of Moessbauer experiments of other authors, indicate a change in the average nuclear charge radius of ^{125}Te at the $3/2^+ \rightarrow 1/2^+$ transition of $\delta R/R = 6.3 \times 10^{-5}$. (auth)

156 APPLICATION OF PASSYNSKY'S METHOD FOR DETERMINATION OF HYDRATION NUMBERS OF ELECTROLYTES IN WATER–ORGANIC MIXTURES. Ernst, S.; Jezowska-Trzebiatowska, B. (Univ., Wroclaw). J. Phys. Chem.; 79: No. 20, 2113-2116 (25 Sep 1975).

Passynsky's method was applied for the determination of hydration numbers of uranyl salts in aqueous solutions from ultrasonic velocity and density measurements. The hydration numbers of uranyl salts in water–dioxane mixtures were determined by a modification of the above method. Two different procedures were applied and discussed for water–dioxane mixtures. (auth)

157 REACTION OF THORIUM AND $ThCl_4$ WITH UO_2 AND $(Th,U)O_2$ IN FUSED CHLORIDE SALTS. Chiotti, P.; Jha, M. C.; Tschetter, M. J. (Ames Lab., Iowa). Contract W-7405-eng-82. J. Less-Common Met.; 42: No. 2, 141-161 (Sep 1975).

An experimental and theoretical investigation of the reactions of thorium and $ThCl_4$ with UO_2 and $(Th,U)O_2$ in fused KCl–LiCl and NaCl–$MgCl_2$ eutectic salts has been carried out. The equilibrium $ThCl_4 + ThO_2$ reversible $2ThOCl_2$ has been considered in some detail and the maximum solubility of $ThOCl_2$ as a function of the $ThCl_4$ concentration in KCl–LiCl calculated. The activity coefficient of $ThOCl_2$ was estimated from experimental data. Similar calculations were made for the solubility of $UOCl_2$. The reaction of $ThCl_4$ with UO_2 involves three independent reactions. The equilibrium concentration of components in KCl–LiCl salt for the overall reaction $Th + UO_2$ yields $ThO_2 + U$ can be described in terms of two independent reactions, and the experimental data are consistent with available thermodynamic data. The reduction of UO_2 and $(Th,U)O_2$ to produce uranium and ThO_2 has been demonstrated. Methods for separating the uranium from the ThO_2 precipitate are considered briefly. (auth)

158 ELECTROLYTIC PREPARATION OF LANTHANIDE AND ACTINIDE HEXABORIDES USING A MOLTEN, CRYOLITE-BASE ELECTROLYTE. Gomes, J. M.; Uchida, K. (to Secretary of the Interior). US Patent 3,902,973. 2 Sep 1975. Filed date 4 Oct 1973. 6 p.

Lanthanide and actinide hexaborides are electrolytically synthesized using a molten salt electrolyte containing a major portion of cryolite and minor portions of an alkali borate and a source compound to supply the lanthanide or actinide metal. Minor amounts of an alkali hydroxide or carbonate added to the electrolyte tend to improve product recovery and purity. The synthesis may be accomplished in a cell open to the atmosphere to produce highly pure lanthanide and actinide hexaborides. (auth)

Radioactive Waste Treatment

Refer also to abstracts 90 and 581.

159 (BNWL--1932) RESEARCH AND DEVELOPMENT ACTIVITIES WASTE FIXATION PROGRAM. Quarterly Progress Report April--June 1975. McElroy, J. L. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1975. Contract E(45-1)-1830. 96p. Dep. NTIS $5.45.

Four engineering-scale in-canister melting tests established melting rates in 8- and 12-in.-diam canisters and investigated feed-rate limitations resulting from the use of in-canister fins. The ceramic melter was fed glass frit, calcine and frit powder, concentrated slurry, and liquid waste with powdered frits. Comparative leach tests demonstrated that the reference waste glass has higher leach resistance than many common minerals. A test program was completed which shows the pressurization potential of calcines stored in sealed canisters and subjected to high temperatures. Tests were made of glass samples to measure the curium leach rate and assess the effect on leachability of alpha radiation damage. Long-term compatibility of certain refractory oxides in molten glass was studied to select improved refractories for joule-heated melters. Glass samples doped with curium were examined to assess radiation damage and to determine helium diffusion coefficients. Vaporization behavior of glass and calcine samples at elevated temperature was investigated to evaluate storage and shipping accident conditions. Several methods of coating calcine particles were tested for alternative waste fixation. Retention of cesium and ruthenium in supercalcines was studied. The computer code system for providing ordered lists of the highest risk sequences from among the myriad failure sequences associated with large fault trees was successfully demonstrated. (LK)

160 (BNWL-B-443) IMBIBITION-DISPLACEMENT OF AN AQUEOUS INTERSTITIAL LIQUOR BY AN ORGANIC FLUID CONTAINING A SURFACTANT. Sande, W. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1975. Contract E(45-1)-1830. 25p. Dep. NTIS $4.00.

Imbibition was investigated as a method of assisting the removal of interstitial liquor from the salt cake contained in the Hanford underground storage tanks. In this application, imbibition would be the displacement of the interstitial liquor from the salt cake by a heavy organic containing a surfactant. Preliminary studies with a salt cake liquor system formed from $NaNO_3$ alone indicated that a surfactant-tetrachloroethylene system could displace 75 percent of the interstitial liquor. Further investigations were carried out with a sale cake–liquor system containing $NaNO_3$, $NaNO_2$, $NaAlO_2$, and NaOH. Twenty-seven surfactants and two heavy organics, carbon tetrachloride and tetrachloroethylene, were tested. In one test, an anionic surfactant and tetrachloroethylene gave promising results with the latter salt cake; however, these results could not be duplicated. All other surfactants tested gave unsatisfactory results. The presence of NaOH in the salt cake recipe seems to increase the interfacial tension of the interstitial liquid-organic fluid system. Investigations of chemical and radiation stability, corrosion aspects, and ease of removability from the tanks of the heavy organic systems revealed that tetrachloroethylene and carbon tetrachloride are chemically stabilized with additives. It is recommended that a theoretical analysis be made on the application of imbibition to the waste tanks, that experiments be carried out to test the theoretical considerations, and that other promising surfactants such as amphoterics be tested. (auth)

161 (BNWL-SA-5473) EXPERIENCE WITH WASTE VITRIFICATION SYSTEMS AT BATTELLE-NORTHWEST. Chapman, C. C.; Blair, H. T.; Bonner, W. F. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract AT(45-1)-1830. 35p. (CONF-751107-11). Dep. NTIS $4.75.

From 68th annual meeting of American Institute of Chemical Engineering; Los Angeles, California, USA (16 Nov 1975).

Three types of melters: in-can, continuous metallic, and joule-heated ceramic are being developed on an engineering scale for conversion of simulated high-level radioactive waste to a glass form. Work with each of the three melters has progressed for over a year, and ton quantities of glass have been produced. The operation and performance of these systems are described. (auth)

162 (SAND-75-0435, pp 33-67) BENEFICIAL USES OF RADIOISOTOPIC WASTE PROGRAM. Sep 1975.

In Beneficial Uses program. Progress report [for] period ending June 30, 1975. (Sandia Labs., Albuquerque, N. Mex. (USA)).

Activities include efforts to: (1) develop a cost-effective radioisotope separation technology based on column separation techniques associated with the Sandia Solidification Process and (2) develop a broader technology for beneficial applications of the separated isotopes, including engineered radioactive sources and applications facilities and/or devices, and studies related to cost-effectiveness, safety, and security of these sources, facilities, and devices. (LK)

163 CHEMICAL ENGINEERING DEVELOPMENTS IN THE USE OF ION EXCHANGERS FOR WATER TREATMENT. Reuter, H. (VEB Chemiekombinat Bitterfeld (German Democratic

Republic)). Chem. Tech. (Leipzig); 26: No. 7, 403-405(1974). (In German).

The most important chemical engineering improvements in the use of ion exchangers for water treatment are described. In particular, counter current techniques and layered bed processes are elucidated and use of powdered ion exchangers for matting filtration and of ion exchangers for water treatment in metal-working industry are discussed. (INIS)

164 CERAMIC NUCLEAR WASTE FORMS. I. Crystal Chemistry and Phase Formation. McCarthy, G. J.; Davidson, M. T. (Pennsylvania State Univ., University Park). Am. Ceram. Soc. Bull.; 54: No. 9, 782-786(Sep 1975).

From 77th annual meeting of the American Ceramic Society; Washington, DC (7 May 1975).

The radioactive wastes produced by nuclear electric power generation must be prepared in a solid form before storage. This nuclear waste form should be a dense, stable, refractory, and leach-resistant solid. One basic type of information necessary for all nuclear waste form studies is the identification of the phases formed when the simple mixture of waste oxides is subjected to high temperatures. The phase formation behavior in a simplified version of a typical waste was examined. A study of selected subsystems of the Ce–Nd–Fe–Mo–Zr–Cs–Ni–U–Sr–Ba–O systems has shown that a relatively small number of phases having the familiar fluorite, scheelite, perovskite, and spinel structure types are formed in the complete system by firing at 1050 and 1350°C. Weight loss measurements indicated that substantial Cs and Mo were lost during the firings. (auth)

Radioisotope Production

Refer also to abstract 1424.

165 (CNEA-382) PREPARATION AND APPLICATIONS OF $Cs^{137m}Ba$ GENERATORS. Karpeles, A.; Rivero, M. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1974. 16p. (In Spanish). Dep. NTIS (US Sales Only) $4.00.

The preparation of a sterile ^{137m}Ba generator and the properties of the product eluted with different solutions are described. The developed generator uses a very high stable inorganic ion exchanger: hexacyanoferrate deposited on small steel turnings. The high void volume of the absorbing bed allows elution velocities of ≥ 20 ml/min and elution yields over 70%. Elution curves are presented and purities of the product are given for following elutriants: diluted hydrochloric acid and sodium chloride solutions, EDTA and calcium levulinate solutions. The product can be obtained sterile and useful for direct administration to patients for diagnostic studies in nuclear medicine. Applications in medical dynamic studies and radiochemistry teaching are given. (auth)

166 METHOD OF MANUFACTURING A GENERATOR WHICH PRODUCES RADIOISOTOPES AND HAS AN IMPROVED ELUTION EFFICIENCY, AND GENERATOR OBTAINED BY THIS METHOD. Benjamins, H. M.; Kortenoeven, K.; Panek-Finda, H. (to Philips Gloeilampenfabrieken N. V.). Canadian Patent 971,749. 29 Jul 1975. Priority date 2 Mar 1971, Netherlands. 13p.

It has been found that the elution efficiency of generators which produce radioactive isotopes and contain Al_2O_3 as the adsorbent may be greatly improved. The improvement is obtained by providing the adsorbent of the generator with an oxidant before first use of the generator. The oxidant must have a strong affinity for the substrate. Suitable oxidants are chromates and dichromates. (Patent Office Record)

167 THERMAL SEPARATION OF ^{99m}Tc FROM MOLYBDENUM TRIOXIDE. I. Vlcek, J. (Krajska Hygienicka Stanice, Hradec Kralove, Czech.); Rusek, V.; Machan, V.; Rohacek, J.; Kokta, L.; Smejkal, Z.; Vitkova, J.; Vanickova, V. Radioisotopy; 16: No. 3, 413-451(Jul 1975). (In Czech)

The rapid increase of the use of ^{99m}Tc and its compounds leads to new developments in separation methods of technetium from the parent molybdenum. The present work makes use of the different volatility of molybdenum trioxide and technetium oxides for their separation and deals with the application of the method for the construction of a ^{99}Mo–^{99m}Tc generator. The suggested solution eliminates the inadequacies of the hitherto employed sublimation generators, namely the complexity of construction and operation, while maintaining their advantages, i.e., the radionuclidic purity of the product, its high volume activity, low production costs per 3.7×10^7 s^{-1} ^{99m}Tc, high chemical purity of the product and the possibility of processing ^{99}Mo of low specific activity. (auth)

168 THERMAL SEPARATION OF ^{99m}Tc FROM MOLYBDENUM TRIOXIDE. II. Vanickova, V. (Vysoka Skola Chemickotechnologicka, Pardubice, Czech.); Rusek, V.; Vlcek, J. Radioisotopy; 16: No. 3, 453-484(Jul 1975). (In Czech)

The paper deals with thermal separation of ^{99m}Tc from molybdenum trioxide in a stream of carrier gas. A mathematical description of the system ^{99}Mo–^{99m}Tc is presented and a short-account of methods used for the counting of ^{99m}Tc and its radionuclidic impurities is given. The preparation of molybdenum trioxide from non-sterile ^{99m}Tc elution generators is described. A sublimation device heated by two resistance ovens was used for the separation of ^{99m}Tc. The effect of the carrier-gas flow and heating temperature on the course of separation was investigated. It was found that a constant yield of ^{99m}Tc can be maintained by gradual temperature increase while repeating the sublimation. The described method enables the separation of ^{99m}Tc from the system ^{99}Mo–^{99m}Tc with an average yield of 60% in five successive sublimations of the same packing. The radionuclidic impurities present in the starting ^{99}Mo and in the separated technetium were counted with the use of scintillation and semiconductor gamma spectrometry. (auth)

169 CHEMICAL PROCESSING OF CYCLOTRON PRODUCED GALLIUM-67 ON ALUMINA COLUMNS. Kopecky, P.; Mudrova, B. (Ustav Jaderneho Vyzkumu, Rez, Czechoslovakia). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 323-328(Jun 1975).

The use of alumina adsorbent for ^{67}Ga separation was investigated. By this method it is possible to separate ^{67}Ga not only from target amounts of Zn and Cu but also from traces of Fe and Ge. (auth)

170 RADIOISOTOPE AND RADIOPHARMACEUTICAL GENERATORS. Barak, M.; Winchell, H. W. (to Medi-Physics Inc.). US Patent 3,902,849. 2 Sep 1975. Filed date 30 Jul 1973. 8p.

A chromatographic column for generating technetium-99m isotopes and technetium-99m labeled pharmaceuticals in a simple two-step process is described. Technetium-99m pertechnetate in a first step is isolated by adsorption upon an adsorbent packing. Then the technetium-99m in a second step is eluted from the packing, either with an immediately labeled biological compound to form a radiopharmaceutical, or by a controlled volume of eluant to produce a 99m-technetium-bearing eluate of a desired specific concentration. (Official Gazette)

Reactor Fuel Reprocessing

Refer also to abstracts 1178, 1401, 1406, 1415, 1422, and 2489.

171 (CONF-751101-19) MULTIPURPOSE REPROCESSING HOT CELL. Fletcher, R. D. (Allied Chemical Corp., Idaho Falls, Idaho (USA)). 1975. 15p. Dep. NTIS $4.50.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

A multipurpose hot cell is being designed for use at the Idaho Chemical Processing Plant for handling future scheduled fuels that cannot be adequately handled by the existing facilities and equipment. In addition to providing considerable flexibility to handle a wide variety of fuel sizes up to 2,500 lb in weight the design will provide for remote maintenance or replacement of the in-cell equipment with a minimum of exposure to personnel and also provide process piping connections for custom processing of small quantities of fuel. (auth)

172 (GA-A-13275) CONCEPTUAL DESIGN FOR A PROTOTYPE FUEL ELEMENT SIZE-REDUCTION SYSTEM DESIGNATED UNIFRAME. Design Status Report. Baxter, B. J.; Cook, E.; Miller, C. M.; Strand, J. B. (General Atomic Co., San Diego, Calif. (USA)). 1 Sep 1975. Contract AT(04-3)-167. vp. Dep. NTIS $7.60.

The development of a prototypical fuel element crushing system is described. The entire pilot plant process consists of crushing the fuel elements to a size suitable for burning in a fluidized bed to remove excess graphite; separating, crushing, and re-burning the fissile and fertile particles to remove the majority of the remaining graphite; dissolution and separation of the particles from insoluble materials; and solvent extraction separation of the uranium and thorium. The crushing of the fuel elements is accomplished via a three-stage crushing system consisting of two overhead eccentric jaw crushers, a double-roll crusher, and an oversize reduction system to ensure the complete reduction to the desired size. The crushing system is mounted in a special framework which replaces the standard machine frames to utilize gravity flow, eliminate material transport systems, and minimize material hold-up. The entire system has been designated UNIFRAME because of the integrated nature of all the equipment in this special design. The present status of the UNIFRAME design is described along with its operating and maintenance conditions. The cost and time schedules for a former plan and for a proposed expanded plan to complete the development of the concept is also described. (auth)

173 (GA-A--13510) THORIUM UTILIZATION PROGRAM. Quarterly Progress Report for the Period Ending May 31, 1975. (General Atomic Co., San Diego, Calif. (USA)). 15 Aug 1975. Contract AT(04-3)-167. vp. Dep. NTIS $7.60.

The work reported includes the development of unit processes and equipment for reprocessing of High-Temperature Gas-Cooled Reactor (HTGR) fuel and the design and development of an integrated line to demonstrate head-end HTGR reprocessing using unirradiated fuel materials. Work is also described on the evaluation of alternate techniques for fuel reprocessing to surmount possible operating problems with the reference flow sheet and the development of the conceptual design of a target recycle facility to identify the requirements of large-scale recycle of HTGR fuels. (auth)

174 (REG/G-3.31(9-75)) EMERGENCY WATER SUPPLY SYSTEMS FOR FUEL REPROCESSING PLANTS. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). Sep 1975. 4p. NUREG.

Sources of emergency water acceptable to the NRC staff are described and bases for the design of systems that furnish emergency water to the fuel storage pool, high-level radioactive waste storage, fire protection system, certain process vessels, and any other safety-related equipment or system requiring a supply of water to perform the design safety function, directly or indirectly, are presented. (LK)

175 (REG/G-3.32(9-75)) GENERAL DESIGN GUIDE FOR VENTILATION SYSTEMS FOR FUEL REPROCESSING PLANTS. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). Sep 1975. 6p. NUREG.

General safety, occupied area ventilation systems, process area ventilation systems, exhaust ventilation and filtration systems, ventilation system construction and layout ventilation system testing and monitoring, and the quality assurance program are discussed. (LK)

176 PROCESS FOR THE PRODUCTION OF AN AQUEOUS SOLUTION OF URANYL NITRATE BY MEANS OF REPROCESSING IRRADIATED NUCLEAR FUEL. Weech, M. E. (to General Electric Co., Schenectady, N. Y. (USA)). Swiss Patent Document 538429/D/. 15 Aug 1973. 8p. (In German).

A procedure is described for the recovery of irradiated nuclear fuel. The irradiated fuel is dissolved in an aqueous solution of HNO_3 and this solution is contacted with an organic solvent containing TBP in a hydrocarbon immiscible in water as a solvent to extract U, Pu, and Np into the organic solvent. The organic solution is in counter current to an aqueous solution containing enough U to maintain the organic solution at least 90 saturated in U so that the Pu, Np, and fission products are extracted by washing the organic solution. After this washing the reflux aqueous solution is in counter-current contact with a solvent extraction stream containing TBP and a hydrocarbon immiscible in water as solvent. The acidity of the reflux stream is maintained at a molar value of approximately 1 so that the U is separated by the reflux stream and the organic stream containing the U becomes a part of the organic solution. The resulting organic solution containing the U is contacted with an aqueous stream in order to separate the U by extraction from the organic solution. (tr-INIS)

177 SELECTIVE EXTRACTION OF METALS FROM ACIDIC URANIUM(VI) SOLUTIONS USING NEO-TRIDECANO-HYDROXAMIC ACID. Bardoncelli, F.; Grossi, G. (to Comitato Nazionale per l'Energia Nucleare). US Patent 3,900,551. 19 Aug 1975. Priority date 2 Mar 1971, Italy. 8p.

According to this invention neo-alkyl-hydroxamic acids are employed as ion-exchanging agents in processes for liquid-liquid extraction with the aim of separating, purifying dissolved metals and of converting a metal salt solution into a solution of a salt of the same metal but with different anion. In particular it is an objective of this invention to provide a method whereby a molecular pure uranium solution is obtained by selective extraction from a uranium solution delivered by irradiated fuel reprocessing plants and containing plutonium, fission products and other unwanted metals, in which method neo-tridecane-hydroxamic acid is employed as ion exchanger. (Official Gazette)

CONTROLLED THERMONUCLEAR RESEARCH

Plasma Confinement and Heating

Refer also to abstracts 269 and 356.

178 (AD/A–004178) EFFECT OF THE BEAM ON THE SIGNAL OF DISMAGNETIC LOOPS IN BEAM–PLASMA HEATING EXPERIMENTS. Striffler, C. D.; Kapetanakos, C. A. (Naval Research Lab., Washington, D.C. (USA)). Nov 1974. 35p. (NRL-MR–2928). NTIS $3.75.

The effect of an electron beam on the output signal of a diamagnetic loop, used in beam-plasma heating experiments, is studied by examining the diffusion of a magnetic field pulse through a cylindrically symmetric plasma column. The magnetic field pulse is produced by a thin rotating E-layer of linear current 1(t) that has a trapezoidal shape in time. Exact analytical expressions are obtained for the electric and magnetic fields and for the integrated output of a diamagnetic loop placed outside the plasma column. It is shown that the present results are not sensitive to the shape of the beam current pulse. (GRA)

179 (AD/A–004627) STUDIES OF PLASMA CONTAINMENT IN CUSP MAGNETIC FIELD FOR TWO LINER SHAPES. Liewer, P. C.; Boris, J. P. (Naval Research Lab., Washington, D.C. (USA)). Jul 1974. 12p. (NRL-MR–2851). NTIS $3.25.

This note summarizes preliminary computational studies made of plasma confinement in a cusp magnetic field created by liners or coils of two different shapes. The amount of plasma contained was calculated at several radial positions of the liner to model a liner moving inward. It was found that the liner shape and position are important in achieving the lowest ratio of field to plasma energy and hence maximizing the efficiency of the compression. The results suggest further studies requiring a more sophisticated program now under development. (GRA)

180 (CLM-R–144) TRANSIT TIME MAGNETIC PUMPING EXPERIMENTS IN THE PROTO-CLEO STELLARATOR. Millar, W. (UKAEA Research Group, Abingdon, Culham Lab.). Apr 1975. 21p. Dep. NTIS (US Sales Only) $4.25. UK 50 pence.

Experiments are described in which magnetic field perturbations at frequencies ~100 kHz, of the type required for Transit Time Magnetic Pumping, are applied to the PROTO-CLEO stellarator. The chief effect is an increase in the plasma loss rate, which is investigated in some detail. The importance of electrostatic fields is discussed, and attention is drawn to the possibility of operating in a region not explored here, with long wavelength and low frequency. (auth)

181 (EPRI-FF–3, pp 17-23) LASER FUSION. Isaacson, L. K. Jul 1975.

In Fossil Fuel and Advanced Systems Division. Progress report. (Electric Power Research Inst., Palo Alto, Calif. (USA)).

A review is given of laser fusion research progress. The discussion covers both private and public research trends. Some cost figures are given. (MOW)

182 (MATT-1152) IMPURITY TRANSPORT IN A QUIESCENT TOKAMAK PLASMA. Cohen, S. A.; Cecchi, J. L.; Marmar, E. S. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Oct 1975. Contract E(11-1)-3073. 14p. Dep. NTIS $4.00.

Short bursts of aluminum were injected into the Adiabatic Toroidal Compressor (ATC) Tokamak, and measured the time evolution of the radial distributions of highly ionized states of aluminum. The results are compared with a computer code describing neoclassical impurity diffusion and good agreement is found. (auth)

183 (N-75-13628) ION HEATING AND CONTAINMENT IN THE NASA LEWIS BUMPY TORUS PLASMA. Roth, J. R. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). 1974. 16p. (NASA-TM-X-71630; E-8157). NTIS $3.25.

From 16th annual meeting of the American Physical Society; Albuquerque, NM (28-31 October 1974).

Experimental observations were made during steady state operation of a torus experiment at input powers up to 150 kilowatts in deuterium and helium gas. The steady state ion heating method utilizes a modified Penning discharge operated in a bumpy torus confinement geometry. The bumpy torus plasma is acted upon by a combination of strong electric and magnetic fields. In a deuterium plasma, electron temperatures from 14 to 140 electron volts and ion kinetic temperatures from 160 to 1785 electron volts were observed. At least two distinct operating regimes exist, each of which is associated with a characteristic range of background gas pressure and electron temperature. Experimental data show that the average ion residence time in the plasma is virtually independent of magnetic field strength. (auth)

184 (UCID-16872) LASER-PELLET HEATING STUDIES FOR PLASMA-TARGET PRODUCTION. Osher, J. E.; Porter, G. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Sep 1975. Contract W-7405-Eng-48. 30p. Dep. NTIS $4.00.

Laser heating of a small pellet to produce an initial plasma target for subsequent energetic neutral-beam trapping and build-up is a relatively new application of laser technology to controlled-fusion, magnetic-confinement experiments. Simple theories explaining the laser-pellet heating interaction suggest two laser-heating methods: either a few-nanoseconds-duration, intense laser pulse on a carefully preheated small pellet or a sufficiently long laser pulse to allow ablative burn through of a larger, initially cold pellet. The ablative burn approach, particularly for the larger pellet sizes of interest here, is favored because of the availability of relatively inexpensive CO_2 lasers with pulse lengths in the 50-ns range. The theory for this model is briefly described and its predictions compared with supporting calculations made with the LASNEX computer code. Preliminary experiments are also described in which a nominally 25-J CO_2 laser was used to provide a 45- to 100-ns pulse incident on one side of a 100-mu m-diam polystyrene pellet. The heated plasma included keV-range ions of H^+, C^{4+}, C^{5+}, and C^{6+}. Rocket reaction of the pellet from the focal zone was expected and was consistent with the observed limit of one-sided absorption to the range of a few joules. (auth)

185 PLASMA-RETURN-CURRENT HEATING BY RELATIVISTIC ELECTRON BEAMS WITH $v/\gamma \sim 10$. Prono, D.; Ecker, B.; Bergstrom, N.; Benford, J. (Physics International Company, San Leandro, California 94577). Phys. Rev. Lett. 35: No. 7, 438-441 (18 Aug 1975).

We report experimental results of hydrogen-plasma heating using very intense relativistic electron beams with v/γ up to 10. The beam-plasma interaction process is found to be plasma-return-current heating with strongly anomalous plasma resistivity. Peak plasma energy is 1.5×10^{19} eV/cm^3, corresponding to T_e=2.2 keV at $n_e=6.7\times10^{15}$ cm^{-3}. (auth)

186 MEASUREMENT OF THERMAL CONDUCTIVITY IN A LASER-HEATED PLASMA. White, M.S.; Kilkenny, J.D.; Dangor, A.E. (Imperial College, London, England). Phys. Rev. Lett. 35: No. 8, 524-527 (25 Aug 1975).

The plasma thermal conductivity has been measured in a CO_2-laser-heated Z pinch at a number density of 8×10^{16} cm^{-3}. Ruby-laser scattering was used to monitor the heating and rarefaction. Comparison with a numerical simulation indicates that the thermal conductivity is about a factor of 2 below that predicted by classical theory. (auth)

187 SIMULATION OF TURBULENT PLASMA HEATING BY MODERATELY STRONG OSCILLATING TWO-STREAM INSTABILITIES. Katz, J.I.; De Groot, J.S.; Faehl, R.J. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Fluids 18: No. 9, 1173-1177 (Sept 1975).

Numerical simulations are used to investigate plasma heating by the oscillating, two-stream instability at moderate amplitude. Substantially all the absorbed electromagnetic energy goes into production of a suprathermal electron population. A simple functional form describes the shape of the suprathermal distribution function, which is proportional to v^{-2} over a wide velocity range. This holds for a wide range of driving field amplitude. The multiplicative constant increases linearly with time within a simulation. The plasma electric field spectrum has a characteristic power law shape, which is interpreted as the result of the waves coming into quasi-thermal balance with electrons near their phase velocity. The results for the electron distribution function are in qualitative agreement with experiments by Dreicer, Ellis, and Ingraham, but they disagree with those of Mizuno and De Groot and of Porkolab. (auth)

188 PLASMA HEATING ABOVE THE LOWER HYBRID FREQUENCY BY LINEAR WAVE ABSORPTION. Schuss, J.J. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Fluids 18: No. 9, 1178-1182 (Sept 1975).

The possibility of heating collisionless toroidal plasmas to high temperatures by means of linear wave absorption above the lower hybrid frequency is discussed. This absorption is mainly due to electron Landau damping and ion damping is neglected. Two methods of heating are considered, propagating a wave across the plasma column and exciting toroidal modes. WKB solutions of the first method show that the incident wave must be within a narrow range of k_z for its energy to be

uniformly deposited into the plasma. Toroidal mode solutions indicate that this band of k_z may be significantly widened by lower k_z waves which drive slightly damped toroidal modes. The conditions on k_z for accessibility and heating are calculated and the advantages of such an approach are discussed. (auth)

189 TRANSPORT PROPERTIES OF A TOROIDAL PLASMA AT INTERMEDIATE-TO-HIGH COLLISION FREQUENCIES. Rawls, J.M.; Chu, M.S.; Hinton, F.L. (General Atomic Company, San Diego, California 92138). Phys. Fluids 18: No. 9, 1160-1166 (Sept 1975).

Neoclassical transport coefficients are computed in a large aspect ratio toroidal magnetic confinement system in order to examine the transition between the plateau and Pfirsch–Schlüter regimes. The calculation employs a hybrid collision operator combining Krook and pitch angle scattering terms with the identical particle collision frequency taken to be a function of velocity which is determined from a fit to known exact results for classical transport. A simple approximate analytic form is presented which incorporates both these results and the results of Hinton and Rosenbluth for lower collision frequencies. (auth)

190 PLASMA MOTION INDUCED BY LASER HEATING. Steinhauer, L.C. (Mathematical Sciences Northwest, Inc., Bellevue, Washington 98009). Phys. Fluids 18: No. 9, 1131-1135 (Sept 1975).

Laser-induced motion is calculated for an underdense magnetically confined plasma column subjected to axial laser heating. Perturbation velocities and densities are determined for small values of the disturbance parameter defined as the ratio of the speed of sound to the speed of plasma growth due directly to laser absorption. The calculation confirms that for small values of the disturbance parameter, laser-induced plasma motion is unimportant. A number of relevant laser heating experiments are examined and classified with respect to induced plasma motions. (auth)

191 VISCOSITY IN MAGNETOSONIC PLASMA HEATING. Roife, I.M. Sov. Phys.—Tech. Phys. 20: No. 1, 103-104 (July 1975).

By estimating the second viscosity coefficient for the single-fluid model of a hot plasma column that supports magnetosonic modes it is possible to derive the quality factor for those modes. Conditions for maximum ion heating near $\beta_e = 1$ are determined. (auth)

192 SPATIAL DENSITY VARIATION IN THE CORONA OF A LASER PLASMA AT FLUXES 10^{14}–10^{15} W/cm^2. Zakharenkov, Yu.A.; Zorev, N.N.; Krokhin, O.N.; Mikhailov, Yu.A.; Rupasov, A.A.; Sklizkov, G.V.; Shikanov, A.S. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). JETP Lett. 21: No. 9, 259-261 (5 May 1975).

Different procedures are used to investigate the dynamics of the spreading of a laser plasma during the course of a heating pulse. The formation of a perturbation on the profile of the electron density is observed. (auth)

193 THEORY OF PLASMA HEATING BY NONLINEAR EXCITATION OF LOWER HYBRID RESONANCE. Hasegawa, A.; Chen, L. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Fluids 18: No. 10, 1321-1326 (Oct 1975).

A theory of plasma heating when the lower hybrid wave is parametrically excited by an electromagnetic pump at frequency ω_0 close to the lower hybrid resonant frequency ω_{lh} (i.e., $\omega_0 < \sqrt{2}\omega_{lh}$) is presented. In this case, the excitation is made through electron nonlinear Landau damping. The saturation level is obtained using the cascading model and the heating rate is calculated. It is shown that the heating rate may be obtained without knowing the saturation spectrum of the excited turbulence. In particular, the heating rate of ions is given by $\nu_f \epsilon_E^2/2$, where $\nu_f \simeq (1/16\omega_{lh})(\omega_{pe}/\omega_0)^2 (E_0/B_0\nu_e)^2$. (auth)

194 OPTIMAL LASER PLASMA HEATING IN A SOLENOIDAL MAGNETIC FIELD. Vagners, J.; Neal, R.D.; Vlases, G.C. (University of Washington, Seattle, Washington 98195). Phys. Fluids 18: No. 10, 1314-1320 (Oct 1975).

Laser heating of a plasma column confined by a solenoidal magnetic field is studied via modern optimal control techniques. Plasma density and temperature at a given axial position along the plasma column are assumed to be uniform in the radial direction but time varying; the (local) laser intensity as a function of time is taken as the control. Classical absorption of laser energy by the electrons through the mechanism of inverse bremsstrahlung is assumed, with ion heating resulting from collisional energy transfer. It is also assumed that electrical conductivity is very large, so that particle diffusion and Ohmic heating are negligible. The theory for determining optimal laser pulse shapes in time, $I(t)$, to achieve specified performance criteria is then developed and applied to the problem of raising the ion temperature from an initial equilibrium value to a prescribed level in minimum time. Constraints on the maximum laser intensity and energy available are imposed and typical numerical results presented. (auth)

195 CASCADE HEATING IN A LASER IRRADIATED PLASMA. Yuen, S.Y. (Department of Physics and Francis Bitter National Magnet Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Fluids 18: No. 10, 1308-1313 (Oct 1975).

A nonlinear electromagnetic theory is developed for studying the interaction of laser radiation with the collective waves of a two-component warm plasma. Analytic expressions are obtained for steady-state (time-saturation) spectra and wave energies of the Langmuir and ion-acoustic fluctuations excited by parametric decay instabilities. The dominant nonlinear mechanism treated is the coherent excitation of secondary electrostatic waves by the Langmuir oscillation, so that the results are directly relevant when the electron temperature far exceeds the ion temperature. Threshold values for these secondary excitations are determined. Effective anomalous absorption coefficients for electrons and ions are also calculated. The nature of the depletion nonlinearity is discussed. (auth)

196 MAGNETIC FIELDS DUE TO RESONANCE ABSORPTION OF LASER LIGHT. Thomson, J.J.; Max, C.E.; Estabrook, K. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Rev. Lett. 35: No. 10, 663-667 (8 Sept 1975).

We discuss the generation of dc magnetic fields due to the resonant excitation of plasma waves by an obliquely incident, plane-polarized laser beam. We show that the averaged forces on the electrons due to the plasma waves produce magnetic fields perpendicular to the plane of incidence. Megagauss field levels may be reached. Computer simulations verify our theoretical predictions. (auth)

197 PLASMA CONFINEMENT IN PRESENCE OF MAGNETICALLY SHIELDED SUPPORTS. Lehnert, B. (Royal Inst. of Tech., Stockholm). Plasma Phys.; 17: No. 7-8, 501-524(Jul 1975).

During recent investigations on plasma confinement by internal ring systems with magnetically shielded supports some authors have arrived at contradictory conclusions. This paper reconsiders support shielding in terms of the problems of plasma cut-off at the support surfaces, the plasma equilibrium in presence of the support field, non-adiabatic effects on transit and trapped particles, and magnetic field misalignment in the weak-field regions: (i) The support ratio $R_s = d_t/2d_1g_s$ and the curvature ratio $R_B = r_B/2d_1g_s$ are crucial parameters in respect to the confinement. Here $2d_1$ and d_t are the separation distance and the length of the supports, r_B is the local radius of curvature of the main field in the support region, and g_s is a monotonically increasing function of the support magnetization current reaching $g_s = 1$ in the force-free case. As a necessary condition for an effective confinement, R_s and R_B have to be chosen substantially larger than unity. (ii) Taking all effects and parameter values into proper account, there are found to be no contradictions between theory and experiments so far. In particular, for some earlier experiments with large observed loss rates such as in the Wisconsin octupole, theory predicts a poor confinement, whereas the decreased loss levels observed in presence of support shielding in the Stockholm F IV device and in the Los Alamos quadrupole also become consistent with theory. (auth)

198 CHARGE EXCHANGE AT THE SURFACE OF MIRROR-CONFINED PLASMAS. Fowler, T. K. (Univ. of California, Livermore). Plasma Phys.; 17: No. 7-8, 583-587(Jul 1975).

A condition is derived in order that charge-exchange losses be negligible in a mirror plasma-confinement experiment in which the plasma is sustained by neutral injection in steady state. The condition is more severe than the "burnout" condition that neutrals be screened out of the plasma interior. (auth)

199 ELECTROSTATIC AND ELECTROMAGNETIC CONFINEMENT OF PLASMAS AND THE PHENOMENOLOGY OF RELATIVISTIC ELECTRON BEAMS. Conference Held at New York, NY, March 5--7, 1974. Marshall, L. C.; Sahlin, H. L. (eds.). Ann. N. Y. Acad. Sci.; 251: 1-711(8 May 1975).

Separate abstracts were prepared for the papers and they are included in this issue. The papers cover information on the electromagnetic confinement of plasma, electrostatic confinement, interaction of relativistic electron beams with targets and plasmas, electromagnetic and electrostatic confinement, relativistic electron beams, new techniques, and original new approaches. (MOW)

For abstracts of individual papers see: 200–217, 225, 241–244, 249, 269, 270, 282, 283, 313, 347–353, 392, 393, 490, and 491.

200 INTERACTION ON INTENSE MICROWAVE RADIATION AND FULLY IONIZED HYDROGEN PLASMA. I. High-Density System. Ensley, D. L. (Univ. of California, Livermore). Contract W-7405-eng-48. Ann. N.Y. Acad. Sci.; 251: 30-73(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The two general categories of interactions between a plasma and microwave field are discussed: (1) individual particle behavior, and (2) collective effects plasma interactions between (1) and (2). All cases considered here deal with omega/omega/sub pe/ much less than 1. Then delta approximately c/omega/sub p/ much less than 1. Further KT/sub e/ greater than ½ keV; also the radiation wavelength greater than 0.01 cm. (MOW)

201 NONLINEAR PROBLEMS CONNECTED WITH INTERACTION OF HIGH-FREQUENCY MICROWAVES WITH PLASMA. Motz, H. (Oxford Univ.). Ann. N.Y. Acad. Sci.; 251: 74-93(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The relation between microwave experiments and laser fusion is discussed. The growth of parametric instabilities and Raman and Brillouin scattering is discussed. Nonlinear processes are reviewed for a uniform and then nonuniform plasma. Some experimental studies are then described. (MOW)

202 RECENT DEVELOPMENTS IN ELECTROSTATIC CONFINEMENT: EXPERIMENTAL. Verdeyen, J. T.; Cherrington, B. E.; Swanson, D. A.; Meeker, D. J. (Univ. of Illinois, Urbana). Contract AT(11-1)-2323. Ann. N. Y. Acad. Sci.; 251: 126-138(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

These experiments were designed to examine the potential structure and charge densities within the interior of an electrostatic device so as to ascertain whether alternating layers of space charge can exist. Deep potential wells were measured with single species injection, with multiple wells being formed in the presence of background gas. The methods used for investigating electrostatic confinement are described. (MOW)

203 RECENT DEVELOPMENTS IN ELECTROSTATIC CONFINEMENT: THEORETICAL. Cherrington, B. E.; Verdeyen, J. T.; Swanson, D. A. (Univ. of Illinois, Urbana). Contract AT(11-1)-2323. Ann. N. Y. Acad. Sci.; 251: 139-151(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York NY (5 Mar 1974).

The solution of Poisson's Equation in spherical coordinates for electron injection with spreads in total energy and in angular energy provides a realistic theoretical model for the potential within a spherical device for single-species injection. The agreement between this theory and experimental results on similar devices is excellent. The essential factor in obtaining good agreement is the inclusion of the angular motion of the injected particles. Preliminary theoretical results for two-species injection indicate that this theoretical approach may also be able to be used to provide a model of the multiple potential well structure observed in experimental devices for electron injection into a low pressure gas background. (auth)

204 ELECTROSTATIC AND ELECTROMAGNETIC HIGH-TEMPERATURE PLASMA TRAPS. Lavrent'ev, O. A. (Physical-Technical Inst., Kharkov). Ann. N. Y. Acad. Sci.; 251: 152-178 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Theoretical and experimental studies of thermonuclear systems using electrostatic thermal insulation of high-temperature plasma along with magnetic insulation are described. The field of force may be either an electric field or a combination of electric and magnetic fields. (MOW)

205 MEASUREMENTS ON A SPHERICAL ELECTROSTATIC CONFINEMENT SYSTEM EMPLOYING SIX ION GUNS. Gardner, A. L.; Hatch, D. M.; Chan, A. I. Y.; Evans, R. P. (Brigham Young Univ., Provo, UT). Contract AT(11-1)-2180. Ann. N. Y. Acad. Sci.; 251: 179-189(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

A spherical electrostatic confinement system using ion injection from six ion guns was studied with microwave cavity techniques to measure the electron density within the confinement volume. (MOW)

206 THEORETICAL MODELS OF ELECTROSTATIC CONFINEMENT EXPERIMENTS. Klevans, E. H. (Pennsylvania State Univ., University Park). Ann. N. Y. Acad. Sci.; 251: 190-212 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Theoretical models are developed that produce shallow potential wells, deep wells, and spatially oscillating potentials. The basic procedure in all of the models is to solve Poisson's equation subject to certain boundary conditions. Spherical symmetry is assumed throughout. (MOW)

207 REVIEW OF ELECTROSTATIC AND ELECTROMAGNETIC CONFINEMENT EXPERIMENTS MADE AT THE FRENCH AEC. Consoli, T. (CEN, Grenoble, France). Ann. N. Y. Acad. Sci.; 251: 322-345(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The review covers work during the period 1957 through 1974 both on the electrostatic (or electromagnetic) plasma confinement and on the plasma acceleration effects due to the combination of an electromagnetic field with a static magnetic field. (MOW)

208 ELECTRIC-MAGNETIC CONFINEMENT. Dolan, T. J. (Univ. of Missouri, Rolla). Ann. N. Y. Acad. Sci.; 251: 358-366 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The theoretical plasma confinement times for an electromagnetic trap, which is an electrostatically plugged magnetic cusp device, are calculated. The plasma may be produced by electron beam injection or by other methods. Electron losses along field lines are inhibited by negative electrodes (cathodes) placed at the cusp openings. The main electron losses are then by diffusion in velocity space over the potential barrier and by collisional diffusion across the magnetic field. After a few ions are lost, the excess negative charge of the plasma creates a negative potential well in which the remaining ions are electrostatically trapped. (MOW)

209 PROGRESS REPORT ON THE KEMP II EXPERIMENT: PLASMA CONFINEMENT IN AN ELECTROSTATICALLY STOPPERED SPINDLE CUSP MAGNETIC FIELD. Stansfield, B. L.; Larsen, J. M.; Bergevin, B.; Bolduc, L.; Couture, P.; Gaudreau, J.; Lafrance, Y.; Gregory, B. C. (Univ. of Quebec). Ann. N.Y. Acad. Sci.; 251: 367-369(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

A brief summary is given of progress made in the KEMP II experiment at the INRS-Energie, Universite du Quebec, at Varennes near Montreal. The experiment involves a magnetic spindle cusp plasma confinement device with electrostatic fields applied in the ring and point cusps to reduce charged particle leakage. (MOW)

210 CONFINEMENT OF LASER-PRODUCED PLASMA IN RESONANT CAVITIES BY RF ELECTROMAGNETIC FIELDS. Dean, S. O. (Atomic Energy Commission, Washington, DC). Ann. N.Y. Acad. Sci.; 251: 381-393(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Pressure and energy balance calculations are described for such a system. Radiofrequency power requirements and maintenance of a superconductor near a thermonuclear plasma are discussed. Some requirements for an actual experiment are given. (MOW)

211 PROPERTIES OF RADIOFREQUENCY-CONFINED PLASMAS. Hatch, A. J. (Argonne National Lab., IL). Ann. N.Y. Acad. Sci.; 251: 394-406(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

A theoretical review is given of rf confinement research from 1960 to the present. New results described here include measurements of the luminosity distribution and the floating potential of the confined plasma. (MOW)

212 PLASMA HEATING BY RELATIVISTIC ELECTRON BEAMS AND APPLICATIONS TO CONTROLLED FUSION. Levine, L. S.; Shanny, R. A. (Naval Research Lab., Washington, DC). Ann. N.Y. Acad. Sci.; 251: 421-440(8 May 1975).

From conference on electrostatic and electromagnetic confine-

ment of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

A review is given of recent experimental results obtained by two of the NRL relativistic electron beam generators, TRITON and SOL, in the study of the interaction of relativistic electron beams and plasmas. Some of the possible implications of these results to the controlled thermonuclear fusion research effort are discussed. (MOW)

213 THEORY OF RELAXATION OF RELATIVISTIC ELECTRON BEAMS IN A PLASMA. Breizman, B. N.; Ryutov, D. D. (Inst. of Nuclear Physics, Novosibirsk, USSR). Ann. N.Y. Acad. Sci.; 251: 458-471 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The injection of a relativistic electron beam into a straight system filled with preliminary plasma is discussed. The system can be an ordinary mirror machine or the multiple mirror machine, or a machine with inertial longitudinal confinement. The beam is injected from the end of the installation and propagates through the plasma along the field lines. The excitation of Langmuir oscillations by relativistic electron beams is discussed along with several nonlinear processes. (MOW)

214 HIGH-ENERGY ELECTRON AND ION RINGS FOR PLASMA CONFINEMENT. Fleischmann, H. H. (Cornell Univ., Ithaca, NY). Contract AT(11-1)-2319. Ann. N.Y. Acad. Sci.; 251: 472-482 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

A review of some of the basic relationships, questions, and merits pertaining to charged-particle ring confinement is given. Some experimental results obtained with the field-reversing relativistic electron rings generated in the RECE-Berta device at Cornell are described. From this analysis, it appears that sizeable energy gains and a number of technological advantages can be expected from such systems. (MOW)

215 HEATING OF DENSE PLASMA BY INTENSE RELATIVISTIC BEAMS. Vitkovitsky, I. M.; Friedman, M. (Naval Research Lab., Washington, DC). Ann. N.Y. Acad. Sci.; 251: 483-493 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Preliminary experiments are described that utilize some of the unique properties of intense electron beams to help achieve the necessary conditions of high energy and power density. The experiments are divided into two groups, dealing with the study of beam dynamics and with plasma heating. (MOW)

216 ELECTROMAGNETIC RING CONFINEMENT OF PLASMAS. Lehnert, B. (Royal Inst. of Tech., Stockholm). Ann. N.Y. Acad. Sci.; 251: 550-567 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The research program conducted in Stockholm is reviewed. It is characterized by a combination of the following approaches: (1) Steady-state confinement is produced by a purely poloidal main magnetic field, generated by internal ring-shaped conductors suspended by magnetically shielded supports. Investigations of open rotating plasma systems are included as a supplementary line. (2) The ion density is chosen in a range in which the plasma body becomes impermeable to neutral gas particles. (3) Stabilization against flute-type disturbances is achieved by the joint action of a number of intrinsic plasma effects, in combination with special boundary conditions and distributions of plasma and neutral gas being established in the case of impermeable steady-state plasma system. (4) Plasma heating is provided by imposed electric fields of high and low frequencies. (MOW)

217 PLASMA CONFINEMENT BY MEGAGAUSS MAGNETIC FIELDS. Robson, A. E. (Naval Research Lab., Washington, DC). Ann. N.Y. Acad. Sci.; 251: 649-667 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The basic dynamics of linear compression systems are discussed. Scaling laws were derived for the linear theta pinch and cusped geometries. (MOW)

Plasma Diagnostics

Refer also to abstracts 186, 276, 342, 2206, and 2552.

218 (AD/A-004624) LASER SCATTERING SYSTEM ON THE NRL 'TRITON' EXPERIMENT. Gerber, K. A. (Naval Research Lab., Washington, D.C. (USA)). Jun 1974. 38p. (NRL-MR-2818). NTIS $3.75.

A detailed description of a working, state-of-the-art laser scattering system as specifically employed on the N.R.L. 'Triton' experiment is given. The design considerations, problems and solutions, calibrations, analysis and general physics involved can be applied in designing a laser scattering system to probe almost any laboratory plasma. (GRA)

219 (AED-CONF-75-043-032) NON-EQUILIBRIUM EFFECTS IN THE PLASMAS. Einfeld, D. 1975. 7p. (In German). INIS.

From spring meeting of the Fachausschuesse Kurzzeitphysik and Plasma- und Gasentladungsphysik of the DPG; Duesseldorf, F. R. Germany (4 Mar 1975).

Radial dependences of non-equilibrium effects of a He plasma were studied in a wall-stabilized short-time discharge. The electron density ($n_e = 2.5 \times 10^{22} m^{-3}$), the electron temperature and the equilibrium shift were determined by calculations of the continuum beam density and the beam densities of one He-I and one He-II line, respectively. In the discharge axis, the overpopulation factors of the ground state of He-I and He-II are about 75. As the distance to the axis increases, they increase for He-I and decrease for He-II. Except for the usual errors of measurement, the overpopulation factors found here correspond to those calculated from the balance equations (Drawin). (auth)

220 (EUR-CEA-FC-764) MEASUREMENT METHODS FOR THE PLASMA OF THE T.F.R. TOKOMAK. Etievant, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Feb 1975. 52p. (In French). Dep. NTIS (US Sales Only) $5.75.

The diagnostic techniques used to study the main parameters of the plasma of TFR (electron and ion temperature, current density), the electrical behavior of the discharge, the densities of neutral gas and of impurities and the parameters of plasma turbulence are reviewed. (auth)

221 (N-74-32192) NEW METHOD OF VELOCITY MEASUREMENT FOR FLOWING PLASMAS BY MEANS OF DOPPLER SHIFT. Kelm, S. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Stuttgart (F. R. Germany)). 1974. 21p. (DLR-MITT-74-04). NTIS $3.25.

A method of velocity measurement for a flowing plasma is proposed for a range of 1000 to 2000 m/s. The Doppler shift of spectral lines can be measured by position diodes of semiconducting material. Light input signal for the diode must lie over the noise level, therefore, an image intensifier tube must be used for the light amplification of the spectral line. Calculation of the absolute light intensity for the plasma flow shows that the use of an image intensifier is necessary. The method described here for measuring velocities has a better accuracy than the other methods by which the very small Doppler shift on photographic plates is measured directly. (auth)

222 ELECTRICAL PROPERTIES OF RICH HYDROCARBON FLAMES. Sodha, M.S.; Sagoo, M.S.; Chandra, A.; Ghatak, A.K. (Department of Physics, Indian Institute of Technology, New Delhi-110029, India). J. Appl. Phys. 46: No. 9, 3806-3808 (Sept 1975).

This paper presents measurement of electrical properties of rich hydrocarbon flames having colloidal carbon particles and comparison of the experimental results with the theory of colloidal plasmas. It is seen that in air-hydrocarbon flames the thermionic emission from colloidal carbon particles is the dominant process determining the electron density for temperatures around 1600 °K and above. (auth)

223 MICROWAVE METHOD FOR MEASURING ELECTRON VELOCITY DISTRIBUTION. Gorozhanin, D.V.; Ivanov, B.I.; Prishchepov, V.P. Sov. Phys.-Tech. Phys. 20: No. 1, 24-28 (July 1975).

Further work on a microwave method for measuring the longitudinal electron velocity distribution in a plasma is reported. Equations are derived relating the distribution function to the shape of the absorption curve for electromagnetic waves in a plasma near the electron gyroresonance. Experiments confirm that absolute as well as relative distribution functions can be measured. The applicability of this method for measuring the velocity modulation of an electron beam is discussed. (auth)

224 MULTICHANNEL ENERGY AND MASS ANALYZER FOR ATOMIC PARTICLES. Afrosimov, V.V.; Berezovskii, E.L.; Gladkovskii, I.P.; Kislyakov, A.I.; Petrov, M.P.; Sadovnikov, V.A. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR). Sov. Phys.-Tech. Phys. 20: No. 1, 33-37 (July 1975).

A five-channel analyzer has been developed for analyzing the atoms and ions emitted by a hot plasma; the atoms are analyzed after ionization by stripping in a gas. The properties of the secondary ions are determined by magnetic—electric or double electric analysis; in the former case it is possible to obtain the mass spectrum as well as the energy spectrum of the particles. The analyzer is calibrated by beams of hydrogen and deuterium atoms over the energy range 200–10,000 eV. The calibration is carried out with single collisions of the atoms with nitrogen molecules, injected at a constant rate into the stripping chamber. In addition, an effort is made to improve the sensitivity of the analyzer by calibrating it for collisions of atoms with a thick gaseous target, obtained by pulsed injection of helium into the stripping chamber. The sensitivity of the analyzer is increased by a factor of 2.5–20 as a result, depending on the energy of the atoms. Illustrative energy distributions obtained with this analyzer for atoms from the T−4 are given. (auth)

225 HIGH-DENSITY IONIZATION WITH AN INTENSE LINEAR FOCUS DISCHARGE. Lee, T. N. (Naval Research Lab., Washington, DC). Ann. N.Y. Acad. Sci.; 251: 112-125(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Some experimental results obtained with a linear focus device are described. Measurements include plasma diagnostics made with fast photography, pinhole x-ray photography, and x-ray spectroscopy in the photon energy range of 6 to 35[0] keV. (MOW)

226 Z-PINCH DISCHARGE IN HIGH-PRESSURE HELIUM. Preston, J. M. Vancouver, B. C.; Univ. of British Columbia (1974). vp. National Library of Canada, Ottawa.

Thesis (Ph. D.).

Improvements to the laser excited interferometer previously constructed in this laboratory are described. The use of a rotating retro-reflector in the interferometer cavity and electronic circuitry permit direct recording of electron densities. The sensitivity of the interferometer is 5×10^{15} cm^{-2}, and the temporal resolution is 0.1 μsec. Pyrex tubes, terminated by windows, enclosing the laser beam, have been used to improve spatial resolution. The effects of the tubes and of all other sources of error associated with interferometric measurements of electron densities, have been carefully assessed. A Z-pinch discharge in 4 torr helium was studied with this instrument and with spectroscopic determinations of electron temperature. Under the conditions chosen, the pinching plasma does not reach the axis of the discharge tube, but stops at a radius of 2.7 cm. The shock front caused by the pinching action has been shown to be weak. Longitudinal structure, due to heat flux, characteristic cathode behavior, and variations in timing of the pinching action, has been found. (Diss. Abstr. Int., B)

227 INTERPRETATION OF EXCITATION TEMPERATURE MEASUREMENTS IN A CESIUM PLASMA. Fabry, M.; Cussenot, J. R.; Numano, M. (Univ., Nancy). J. Quant. Spectrosc. Radiat. Transfer; 15: No. 9, 811-814(Sep 1975).

Electron densities and temperatures have been measured by using a Langmuir probe, as well as spectroscopic observations of continuum radiation and of spectral lines, in a cesium plasma. It is shown that the excitation temperatures determined from relative intensities of spectral lines do not always agree with electron temperature determinations. An interpretation of this discrepancy is proposed and discussed. (auth)

228 DIAGNOSTICS OF HELIUM PLASMAS UNDER SPECIAL CONSIDERATION OF THE CONTINUOUS SPECTRUM. Einfeld, D. Berlin; Technische Univ. (1974). 160p. (In German). INIS.

Thesis.

From measurements of the spectral beam density of the helium plasma in the region 290 nm to 650 nm, transition probabilities, Gaunt factors, line broadening parameters and deviations from the state of local thermodynamic equilibrium (L.T.E.) were determined and compared with theoretical data. Using the Gaunt factors experimentally secured in this work for the term n = 3, the electron density could be determined with an uncertainty of ±10% from the emission coefficients of the continuous spectrum. Assuming steady transition of the spectral emission coefficients over the series limit, a numerical method has been given according to which, amongst others, the Gaunt factors for the various series limits can be determined from the transition probabilities of these series. By determining the overpopulation factors of the ground states of the helium atom and the helium ion, a deviation from the L.T.E. state is experimentally detected and quantitatively described. (auth)

229 NEUTRON DIAGNOSTICS OF CONTROLLED THERMONUCLEAR PLASMAS. Southworth, F. H. Gainesville, FL; Univ. of Florida (1974). 98p. University Microfilms Order No. 75-19,392.

Thesis (Ph. D.).

The relatively untouched field of neutron diagnostics for controlled thermonuclear plasmas is attacked from various vantage points. Methods of determining the density radius product, rho R, of a laser induced plasma are presented. These are the first methods published of diagnosing rho R using the emitted neutrons from the plasma. One method relies on the ratio of the relative amount of neutrons emitted from D(d,n)^{3}He reactions to those from the D(t,n)^{4}He reactions in an initially pure deuterium plasma. The other method uses the ratio of the unscattered neutron flux emitted from the laser induced plasma to the scattered and hence energetically degraded neutron flux. Ion temperature can be determined through implementation of two other derived methods. One utilizes the relative neutron flux from differing reactions with a Maxwellian plasma while the other uses the energy spectrum of the neutrons emitted from a particular reaction. Extensions of the latter method give the neutron spectrum for non-thermonuclear neutron sources in laser induced plasmas and the Two Component Tokomak. (Diss. Abstr. Int., B)

Plasma Kinetics (General)

230 (AD/A−003730) PLASMA DENSITY MEASUREMENTS BY ELECTRON PLASMA WAVE PULSES IN A Q-MACHINE. Sugai, H.; Mark, E. (Innsbruck Univ. (Austria). Inst. fuer Theoretische Physik). 5 Jun 1974. Contract F44620-72-C-0016. 18p. (UNICP-SR−102). NTIS $3.25.

An accurate determination of plasma densities in a Q-machine can be given by observations of electron plasma wave pulses. A universal chart to evaluate the plasma density from the propagation speed of wave pulses is provided. It is shown that the radial density distribution should be taken into account in this diagnostic method. Comparison between this method and Langmuir probe methods is presented. (GRA)

231 (AD/A-004150) THEORETICAL STUDIES ON THE TORMAC GEOMETRY, HYDROGEN PLASMA SPECTROSCOPY, AND ELECTRON-MOLECULAR HYDROGEN COLLISIONAL CROSS SECTIONS. Final Report, October 1970—October 1973. Kalman, G.; Bakshi, P. (Boston Univ., Mass. (USA). Dept. of Physics). Nov 1974. Contract F19628-71-C-0079. 41p. NTIS $3.75.

Research results are summarized for work on (i) plasma theoretical problems related to the TORMAC geometry; (ii) hydrogen plasma spectroscopy; (iii) an electron collisional cross-section computer code and calculations. In Section (i) the following problems are discussed: (1) MHD equilibrium and stability; (2) sheath structure; (3) particle motion in the sheath and particle escape; (4) microinstabilities in the sheath; (5) general principles and scaling. Section (ii) deals with the interpretation of experimental results on polarization and spectra of hydrogenic lines from the TORMAC experiment and presents a new and complete theory for the emission of hydrogenic spectra from turbulent plasmas. Section (iii) presents results for inelastic scattering of electrons on molecular hydrogen. (GRA)

232 (AED-CONF-75-043-034) CONTINUUM RADIATION IN HELIUM PLASMAS BETWEEN 290 AND 650 nm. Einfeld, D. 1975. 6p. (In German). INIS.

From spring meeting of the Fachausschuesse Kurzzeitphysik and Plasma- und Gasentladungsphysik of the DPG; Duesseldorf, F. R. Germany (4 Mar 1975).

With abstract.

The intensity of the continuum radiation of a He plasma was determined for wavelengths between 290 and 650 nm in a wall-stabilized short-time discharge (discharge time approximately 500 μsec, Ne approximately 2×10^{16} cm^{-3}, T approximately 4×10^4 K). A comparison between the fg Gaunt factors found by this method and theoretical values following Griem showed deviations up to 50%. The experimentally determined Gaunt factors are confirmed by the determination of a mean emission coefficient in the line radiation region near the series limit under the assumption that this coefficient at the series limit corresponds to the coefficient of the fg continuum. (auth)

233 (DEU-75-6) RESEARCH REPORT 1972. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Plasmaforschung). [nd]. 84p. (In German). INIS.

A report is given in 28 contributions on the scientific progress achieved in 1972. The main problems are: (a) plasma heating and waves in the plasma, (b) plasma focus, (c) short-time technique and (d) laser applications. The report furthermore contains an index of the scientific reports, publications, lectures and dissertations in the period under review. (GE)

234 (DEU-75-7) RESEARCH REPORT 1973. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Plasmaforschung). [nd]. 115p. (In German). INIS.

The scientific progress achieved in 1973 is reported in 29 contributions. The main problems are: (a) plasma heating and waves, (b) plasma focus and shock wave investigations, (c) short-time technique and (d) laser applications in plasma diagnostics. Furthermore, the report contains an index of the scientific reports, publications, lectures and dissertations in the period under review. (GE)

235 EFFECT OF REFLECTION FROM ELECTRODES AND OF ANGULAR SCATTERING ANISOTROPY ON THE SLOW ELECTRON DIFFUSION IN A GAS. 1. Gavallas, L. A.; Kubenskij, A. A. (Leningradskij Inst. Tochnoj Mekhaniki i Optiki (USSR)). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 10, 61-69(Oct 1974). (In Russian).

For English translation see the journal Sov. Phys. J.

A theoretical and experimental study was made of the effect of reflecting electrons from electrons, and of the anisotropy of the angular scattering on the diffusion of slow electrons in a gas. An analytical expression for the diffusion fluxes is obtained by an approximate solution of the kinetic equation. Two configurations of electrons are considered: infinite parallel planes and infinite coaxial cylinders. Measurements performed on a unit with cylindrical electrodes are compared with the results of theoretical calculations. (tr-SJR)

236 OBSERVATION OF CLUMPS IN SIMULATION PLASMA. Dupree, T.H. (Massachusetts Institute of Technology, Cambridge, Massachusetts 02139); Wagner, C.E.; Manheimer, W.M. Phys. Fluids 18: No. 9, 1167-1172 (Sept 1975).

Phase space density granulations (or "clumps") have been observed in a one-dimensional computer simulation plasma. Fluctuations were initially distributed over a wide range of velocities in a Maxwellian plasma. Clumps were observed at the thermal velocity 150 plasma periods later, long after the fluctuations should have decayed down to the thermal equilibrium level according to conventional theory. Within the accuracy of the simulation, the phase space density correlation function obtained from the simulation agrees well with the theoretical expression for clumps. (auth)

237 SYMMETRY IN THE MOTION OF A TWO-COMPONENT PLASMA. Zhmudskii, A.A.; Taranov, V.B. (T. G. Shevchenko Kiev State University). Sov. Phys.—Tech. Phys. 20: No. 1, 98-100 (July 1975).

The two-fluid model of a plasma is studied using the methods from the theory of continuous groups. These methods are used to find new types of exact nonlinear solutions, describing acceleration of the density profile, self-similar plasma dispersion, the self-similar structure of plasma waves close to nodes, and other solutions. It is shown that the shape of the pressure variation as a function of density determines the character of the exact solutions. Equations are obtained which generalize now familiar solutions. (auth)

238 ELECTRON ENERGY BALANCE IN A PULSED HELIUM DISCHARGE. Vagner, S.D.; Kagan, Yu.M.; Slyushov, A.G. (Karelinskii State Pedagogical Institute, Petrozavodsk). Sov. Phys.—Tech. Phys. 20: No. 1, 88-89 (July 1975).

The electron energy balance is analyzed in a pulsed helium discharge, taking account of elastic and inelastic collisions of the electrons with the atoms of gas. The importance of inelastic collisions increases as the current density increases. The rarefaction of the gas caused by the current pulse is of considerable importance. (auth)

239 MULTIPHOTON INVERSE BREMSSTRAHLUNG. Brysk, H. (KMS Fusion, Inc., Ann Arbor, MI). J. Phys., A. (London); 8: No. 8, 1260-1264(Aug 1975).

The net absorption coefficient for multiphoton inverse bremsstrahlung is evaluated in closed form in the limit $\hbar\omega \ll kT$ over the full range of photon flux intensity. Weak- and strong-field expansions are presented and numerical results displayed. (auth)

240 FORCED NEUTRALIZATION OF A POSITIVE ION BEAM BY NEGATIVE IONS. Pelletier, J.; Pomot, C. (CEN, Grenoble, France). Plasma Phys.; 17: No. 7-8, 525-538(Jul 1975). (In French).

A stationary one-dimensional macroscopic description of the forced neutralization of a positive ion beam by negative ions is proposed. From the discussion, three types of solutions are forthcoming, involving a mean or fine neutralization, depending on the injection parameters; periodic, periodic with sheath and aperiodic solutions. The domains of neutralization corresponding to these solutions are analysed in two simple cases. (auth)

241 NEUTRONS AND RADIOISOTOPES PRODUCED BY COLLECTIVE EFFECT ACCELERATION. Luce, J. S. (Univ. of California, Livermore). Ann. N. Y. Acad. Sci.; 251: 217-233 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

A diode system for pinching and accelerating ions is described. Operational parameters of the device are discussed along with some experimental results. (MOW)

242 EQUILIBRIUM, STABILITY, AND SYNCHROTRON EMISSION PROPERTIES OF INTENSE RELATIVISTIC NONNEUTRAL E-LAYERS AND ELECTRON RINGS. Davidson, R. C. (Univ. of Maryland, College Park); Mahajan, S. M. Ann. N.Y. Acad. Sci.; 251: 407-420(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Recent theoretical studies are summarized of the equilibrium, stability, and synchrotron emission properties of intense relativistic nonneutral E-layers and electron rings in a parameter regime that is especially relevant to (1) collective-effect accelerators and (2) the Maryland mirror experiment on nonneutral plasmas. In view of the recent progress in the kinetic description of plasma systems with large electric and/or magnetic self-fields, the equilibrium and stability analysis is carried out within the framework of the Vlasov-Maxwell equations. (MOW)

243 EXPERIMENTAL STUDIES OF COLLECTIVE ION ACCELERATION. Kuswa, G. W. (Sandia Labs., Albuquerque, NM). Ann. N.Y. Acad. Sci.; 251: 514-535(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

This paper briefly treats the history of linear collective acceleration experiments, describes several configurations in which collective ion acceleration has been observed at Sandia Laboratories, and outlines experimental techniques used and results obtained to date. Short explanations of the acceleration process are included, so that similarities in results of ions accelerated in diodes and in drift tubes can be appreciated. (MOW)

244 THEORETICAL MODELS OF COLLECTIVE ION ACCELERATION. Olson, C. L. (Sandia Labs., Albuquerque, NM). Ann. N.Y. Acad. Sci.; 251: 536-549(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Acceleration mechanisms involving space charge fields, inductive fields, and collective wave fields are examined. Seven theoretical models are discussed. Theoretical limitations of the acceleration process are discussed, and two new acceleration schemes that overcome these limitations are presented. (MOW)

245 THERMAL EQUILIBRIUM CRITERIA IN A NITROGEN PLASMA. Cilliers, W. A.; Hey, J. D.; Rash, J. P. S. (Cape Town Univ.). J. Quant. Spectrosc. Radiat. Transfer; 15: No. 10, 963-978(Oct 1975).

A method for obtaining the lower electron density limit for LTE in a nitrogen plasma is described, whereby the experimentally determined ratio of the collisional-radiative ionization and recombination coefficients (S/α) is compared with the corresponding LTE value (Saha ratio). It is argued that if the electron density is increased from values of about 10^{16} cm^{-3}, S/α should tend to the Saha ratio as LTE is approached. For NII and NIII spectral lines, this is found to happen at an electron density of a few times 10^{16} cm^{-3} when the electron temperature is about 3 eV, in good agreement with the LTE criterion of Griem. (auth)

Plasma Kinetics (Experimental)

246 (LA-UR-75-1513) ION TEMPERATURE MEASUREMENTS ON THE ZT-1 REVERSED FIELD PINCH. Howell, R. B.; Karr, H. J.; Forman, P. R. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 5p. (CONF-750944--1). Dep. NTIS $4.00.

From third topical conference on pulsed high beta plasmas; Abingdon, Oxfordshire, UK (9 Sep 1975).

Ion temperatures were measured for the Los Alamos toroidal Z Pinch for several different modes of operation. They show an increase with toroidal current and toroidal current rate of rise. They are highest for low forward bias fields. In the next stage of the program, the ZT-S device with a larger tube bore will be used to determine the effect of scaling the pinch minor radius upon T/sub i/ and T/sub e/. (auth)

247 (N-75-13627) EFFECT OF ANODE RING ARRANGEMENT ON THE SPECTROSCOPIC CHARACTERISTICS OF THE NASA LEWIS BUMPY TORUS PLASMA. Richardson, R. W.

(National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). 1974. 18p. (NASA-TM-X-71636; E-8177). NTIS $3.25.

From 16th annual meeting of the American Physical Society; Albuquerque, NM (28 October 1974).

The modified Penning discharge in the NASA Lewis Bumpy Torus is normally produced by an anode ring at high voltage in each of the 12 magnetic mirror midplanes. For this investigation, the plasma was run with 12, 6, 3, and 1 anode rings. When 3 anode rings were used, the spectroscopically determined relative electron density and mean ion residence time increased by factors of 10 and 5, respectively, in one mode of operation. The discharge is observed to uniformly fill all bumps around the torus regardless of the anode arrangement and number. A plasma density on the axis of 10 to the 11th power cm^3 is estimated for the 3 anode case in one mode of operation based on an observed discharge current to ion loss rate correlation and a measured mean ion residence time of 5 msec. (auth)

248 INTERPRETATION OF NEUTRAL PARTICLE ANALYZER MEASUREMENTS ON PLASMA HAVING AZIMUTHAL DRIFT. Englert, G. W.; Reinmann, J. J.; Laiver, M. R. (Lewis Research Center, Cleveland). Plasma Phys.; 17: No. 7-8, 609-621(Jul 1975).

The theoretical model accounts for drift and cyclotron components of ion motion in a partially ionized plasma. Density and velocity distributions are systematically prescribed. The flux into the neutral particle analyzer (NPA) from this plasma is determined by summing over all charge exchange neutrals in phase space which are directed into apertures. Calculation of the process is continued through the NPA using appropriate cross section data to obtain analyzer output distributions. Theoretical results were compared with NPA measurements on four plasma heating devices having radial electric, E, and axial magnetic, B, fields. Drift, velocity, in the azimuthal direction is identified with E/B. Selection of randomized cyclotron velocity distributions about mean azimuthal drift yield energy distributions which compare well with experiment. Use of data obtained with a bending magnet on the NPA showed that separation between energy distribution curves of various mass species correlate well with a drift divided by mean cyclotron energy parameter of the theory. Use of the theoretical model in conjunction with NPA scans across the plasma aid in estimates of ion density and E field variation with plasma radius. (auth)

249 ELECTRICAL CHARACTERISTICS OF HIGH ENERGY-DENSITY EXPLODED WIRE PLASMAS. Mosher, D.; Stephanakis, S. J.; Hain, K.; Dozier, C. M.; Young, F. C. (Naval Research Lab., Washington, DC). Ann. N.Y. Acad. Sci.; 251: 632-648 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Previously reported and new experimental data are compared with results of an MHD computer code developed to simulate exploded-wire plasma discharges driven by dielectric-transmission-line pulse generators. The electric characteristics of exploded wire plasmas and spectral measurements supporting the MHD model are reported. (MOW)

250 PRODUCTION AND PROPERTIES OF THE HALO IN PINCH PLASMAS. Freund, J. Munich; Technische Univ. (1972). 88p. (In German). INIS.

Thesis.

In pinch discharges, a second plasma region occurs outside the central plasma column, which is designated in a part of the literature as "halo." This outer plasma, as it very distinctly occurs in the experiments with the 5.4 m long compression coil at the linear theta-pinch plant ISAR I, is investigated. (auth)

Plasma Kinetics (Theoretical)

Refer also to abstract 187.

251 (AD/A-004140) STUDIES ON THE SHEATH STRUCTURE IN THE TORMAC GEOMETRY. Kalman, G. (Boston Coll., Chestnut Hill, Mass. (USA). Dept. of Physics). Oct 1974. Contract F19628-71-C-0079. 42p. NTIS $3.75.

The problem of the self-consistent structure of a current carrying sheath separating the magnetic field from the confined plasma in the TORMAC geometry is investigated. The special feature of the problem is the high shear of the magnetic field. The electrons are treated in the MHD approximation, while the ion trajectories are calculated from the equation of motion. The analogy between the sheath problem and the problem of pseudoparticle moving in a two-dimensional potential is exploited to derive the basic equations of the sheath structure. Various simplified models are investigated. (GRA)

252 (EUR-CEA-FC-765) DIFFUSION OF PARTICLES OF PLASMA CONFINED DUE TO COLLISIONLESS DRIFT WAVES. Abdel-Shadid, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Mar 1975. 52p. Dep. NTIS (US Sales Only) $5.75.

The cross-field transport of particles associated with collisionless drift waves, arising in a magnetically confined plasma was measured. The measurements were compared with the numerical results derived from the linear dispersion relation. (auth)

253 (MATT--1143) ORTHOGONAL CONDUCTIVITY OF A TOROIDAL PLASMA. Boozer, A. H. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Sep 1975. Contract E(11-1)-3073. 26p. Dep. NTIS $4.00.

The orthogonal conductivity of a toroidal plasma is calculated in the fluid regime. If the damping time for toroidally directed angular momentum is tau/sub N/, the orthogonal conductivity is shown to be sigma/sub perpendicular to/ equals (rho c^2/ B^2/sub p/)/tau/sub n/ for large tau/sub N/. Here rho is the mass density, c the speed of light and B/sub p/ the poloidal component of the magnetic field. For large tau/sub N/, the flow induced by the orthogonal electric field is almost purely toroidal and of magnitude, c (E/sub r/ - E^0/sub r/)/B/sub p/ where E^0/sub r/ is the electric field required for ambipolar diffusion. (auth)

254 (MATT-1154) TENSOR TRANSFORMATION TECHNIQUE FOR THE TRANSPORT EQUATION. Grainick, S. L. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Oct 1975. Contract E(11-1)-3073. 33p. Dep. NTIS $4.75.

A step-wise tensor transformation technique is presented for the transformation of the single energy group transport equation to an arbitrary spatial coordinate system. Both gradient and divergence forms of the equation are given and the same method is applied to the derivation of the diffusion approximation. It is demonstrated that using an orthogonal representation of the propagation vector will simplify the divergence form of the equation. The application of this technique is in the representation of the transport equation in coordinate systems other than the usual rectangular, cylindrical and spherical ones. Its use is demonstrated by transforming the transport equation to a toroidal coordinate system consisting of nested circular toroids. (auth)

255 (SUIPR-619) SOLUTION OF THE NINE-POINT POISSON OPERATOR BY CYCLIC REDUCTION. Holen, E. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Mar 1975. Contract AT(04-3)-326. 22p. Dep. NTIS $4.25.

Subroutine "BUNPT" was developed from a desire to implement the concept of cyclic reduction, in particular the stable version developed and used so successfully by Buneman, in the inversion of the nine-point Poisson operator, thereby achieving the fourth-order accuracy predicted by this differencing scheme. "BUNPT" will actually solve a Helmholtz equation with Dirichlet boundary conditions when supplied with the value of the charge at each mesh point, as well as the boundary conditions and the value of the charge on all boundaries. Allowance is made for the latter information to be calculated or estimated on the spot, if necessary. (auth)

256 RELATIVISTIC DISTRIBUTION FUNCTIONS AND APPLICATIONS TO ELECTRON BEAMS. Wright, T.P.; Hadley, G.R. (Plasma Theory Division-5241, Sandia Laboratories, Albuquerque, New Mexico 87115). Phys. Rev. A 12: No. 2, 686-697 (Aug 1975).

Equilibrium and monoenergetic distribution functions in the laboratory frame are derived from first principles. Thermodynamically consistent macroscopic properties of relativistic beam systems are defined and discussed as a foundation for specific applications. Characteristics of superpinched relativistic electron beams such as isotropy in the lab frame, rms cone angle of the electrons with respect to the beam axis, and the energy flux across a unit surface at an arbitrary angle to the beam axis are obtained. These properties provide important information on the expected symmetry of irradiation of fusion targets by focused electron beams. A linearized kinetic theory is outlined which leads to an integral expression for the general form of the relativistic plasma dispersion function. (auth)

257 ABSORPTION AT THE ION—ION HYBRID RESONANCE IN AN INHOMOGENEOUS PLASMA. Longinov, A.V.; Panchenko, V.I.; Lyubitskii, A.A. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov). Sov. Phys.—Tech. Phys. 20: No. 1, 13-15 (July 1975).

The absorption of waves in an inhomogeneous magnetized plasma is studied in the region of the ion-ion hybrid resonance. It is assumed that an external electromagnetic wave propagating at right angles to the constant magnetic field is incident on a cold semiinfinite plasma. Numerical methods are used to find the coefficient of reflection, the

absorption of the electromagnetic wave in the resonance layer of plasma, and the field distribution as functions of the frequency, the plasma density, the magnetic field, and the relative ion density. (auth)

258 ANTENNA RESPONSE TO RANDOM ELECTRIC FIELDS DUE TO THERMODYNAMIC DENSITY FLUCTUATIONS IN PLASMAS. Grabowski, R. (Institut für physikalische Weltraumforschung, Fraunhofer Gesellschaft, Freiburg, Germany). Phys. Fluids 18: No. 10, 1387-1392 (Oct 1975).

Thermodynamic density fluctuations of positively and negatively charged components in a plasma are responsible for the occurrence of random electric fields. The response of an antenna to these fields may be characterized by the quadratic or power spectrum of the voltage fluctuations in a measuring device connected to the antenna. The response depends upon the antenna configuration and is described as a filtering effect in wave vector space. Theoretical quadratic spectra are presented for equilibrium plasmas streaming parallel to the antenna axis. The bulk velocity has a strong influence upon the shape of the spectra, especially as it produces a periodic structure. (auth)

259 PLASMA POTENTIAL IN ELECTROSTATICALLY PLUGGED CUSPS AND MIRRORS. Dolan, T.J. (University of Missouri-Rolla, 65401); Stansfield, B.L.; Larsen, J.M. Phys. Fluids 18: No. 10, 1383-1386 (Oct 1975).

From a study of the particle balance equations for ions and electrons confined by a combination of electric and magnetic fields, the potential barrier heights are determined. The theoretical potential well depths are found to be about 20–30% shallower than experimentally measured values, which may be attributed to inaccuracy of the velocity-diffusion loss rates and to uncertainty in experimental parameters. (auth)

260 EQUILIBRIUM PROPERTIES OF A ROTATING NONNEUTRAL *E* LAYER IN A CUSPED MAGNETIC FIELD. Striffler, C.D.; Kapetanakos, C.A. (Naval Research Laboratory, Washington, D.C. 20375); Davidson, R.C. Phys. Fluids 18: No. 10, 1374-1382 (Oct 1975).

The equilibrium properties of a nonneutral rotating *E* layer confined in a linear cusped magnetic field are examined within the framework of the steady-state nonrelativistic Vlasov–Maxwell equations. In order to eliminate the radial loss of electrons at the symmetry plane of the cusp, a negative voltage is applied on a section of the cylindrical conductor that surrounds the *E* layer. The effects of the applied cusped magnetic field and the applied potential on the boundaries of the region occupied by the electrons, together with the influence of the equilibrium space-charge effects, are calculated self-consistently. The specific choice of equilibrium distribution function is one for which all electrons have the same total energy and the same canonical angular momentum. The electron density has a $1/r$ spatial dependence within the *E* layer and the azimuthal velocity profile is different before and after the cusp transition region. The region occupied in configuration space is reduced in size when the applied voltage is increased. Upper limits are found to exist on the applied and self-field potentials in order that the *E* layer occupy a continuous space in the axial direction. A brief discussion of electrostatic stability properties as well as a qualitative comparison with pertinent experimental observations is presented. (auth)

261 NUMERICAL SIMULATION OF NEOCLASSICAL DIFFUSION. Tsang, K.T.; Matsuda, Y.; Okuda, H. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Fluids 18: No. 10, 1282-1286 (Oct 1975).

Cross-field diffusion of a plasma in a model toroidal magnetic field has been studied numerically. The result in a system with toroidal symmetry shows three distinct regimes of diffusion with respect to the collision frequency as predicted by theory. When a weak nonsymmetry is introduced in the model adding a small ripple on the toroidal field, the enhanced diffusion due to superbanana flux is observed in the region of low collision frequencies in agreement with theoretical prediction. (auth)

262 TWO-DIMENSIONAL MAGNETOHYDRODYNAMIC SIMULATION OF TOROIDAL PINCHES. Lui, H.C.; Chu, C.K. (Plasma Physics Laboratory, Columbia University, New York, New York 10027). Phys. Fluids 18: No. 10, 1277-1281 (Oct 1975).

Equations of dissipative magnetohydrodynamics are solved numerically for an axisymmetric toroidal pinch. A circular cross-section screw pinch is treated, although the method is general and extendable to other geometries. Calculated results are compared with experimental results of the SP-1 machine at Jutphaas. Very good agreement is attained, indicating that on short time scales, magnetohydrodynamics gives a good representation of the physical phenomena. (auth)

263 SPECTRUM OF IDEAL MAGNETOHYDRODYNAMICS OF AXISYMMETRIC TOROIDAL SYSTEMS. Goedbloed, J.P. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Fluids 18: No. 10, 1258-1268 (Oct 1975).

The spectrum of ideal magnetohydrodynamics in toroidal systems is shown to concentrate around three continua where the singular fast, the Alfvén, and the slow modes become polarized purely normal and purely tangential to the magnetic surfaces. A new toroidal effect is encountered, viz., coupling of the Alfvén and slow continuum modes by the presence of geodesic curvature. Due to this effect the slow and Alfvén modes are no longer polarized purely parallel and purely perpendicular to the field lines as they are in the case of the diffuse linear pinch. The pure polarizations of these continuum modes are only found asymptotically when $\omega^2 \to \infty$, which point turns out to be a clusterpoint of all three kinds of magnetohydrodynamic modes characterizing each of them uniquely. (auth)

264 ELECTROMAGNETIC ION-BEAM INSTABILITIES IN THE SOLAR WIND. Montgomery, M.D.; Gary, S.P.; Forslund, D.W.; Feldman, W.C. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Rev. Lett. 35: No. 10, 667-670 (8 Sept 1975).

The stability of a plasma consisting of two, unequal, isotropic, ion beams streaming along a uniform magnetic field has been investigated by numerically solving the full electromagnetic, Vlasov, linear dispersion relation for high-β plasmas. Three instabilities are found: One is closely associated with the usual Alfvén mode and the two others with the "fast" or magnetosonic mode. The importance of these instabilities for certain neutral-beam-injection experiments and in the solar wind is emphasized. (auth)

265 RE-NORMALIZED QUASI-LINEAR APPROXIMATION OF PLASMA TURBULENCE. III. Collective Binary Correlations and Turbulent De-Trapping. Misguich, J. H. (CEA, Fontenay-aux-Roses, France); Balescu, R. J. Plasma Phys.; 13: 429-436(Jun 1975).

Collective binary correlations are deduced from the re-normalized quasi-linear (RQL) equation describing the evolution of the singlet average function. For a constant growth rate, a crude calculation suggests that generalized Dupree damping could seriously reduce the trapping of resonant particles. (auth)

266 MONATOMIC PLASMA-THERMAL RADIATION INTERACTION: A WEAKLY-IONIZED KINETIC MODEL. Phillips, W.F. (Utah State Univ., Logan); Arpaci, V. S. J. Plasma Phys.; 13: 523-537(Jun 1975).

A model for the kinetic formulation of a weakly-ionized monatomic gas, which interacts with thermal radiation, is proposed. The collision terms for particle-initiated ionization, developed in terms of a non-equilibrium degree of ionization, and the collision terms for photon-initiated ionization, developed by assuming particles remain in local equilibrium during photon relaxation, all satisfy the usual conservation principles. It is also shown that the proposed model leads to an H theorem. (auth)

267 COHERENT ION ACCELERATION AT A DENSITY GRADIENT. Hsieh, S. L.; Bloomberg, H. W.; Gary, S. P. (William and Mary Coll., Williamsburg, VA). J. Plasma Phys.; 13: 553-562(Jun 1975).

The paper describes a model in which ions are accelerated against the direction of the electric field at a density gradient. A one-dimensional, inhomogeneous, steady-state is constructed, in which cold electrons stream relative to cold ions. The wave-number and amplitude of the fluctuating potential are calculated, then used to compute the trajectories of representative ions trapped in the potential troughs. Ion acceleration to energies an order of magnitude greater than the applied potential is demonstrated. (auth)

268 NON-LINEAR PLASMA TRANSPORT EQUATIONS FOR HIGH FLOW VELOCITY. Salat, A. (Max-Planck-Institut fuer Plasmaphysik, Munich). Plasma Phys.; 17: No. 7-8, 589-607(Jul 1975).

Collision terms for plasma transport equations are derived from the Fokker–Planck equation without the usual linearization in U = flow velocity/thermal velocity. A 13-moment ansatz for the distribution functions includes the linearized dependence of the collision terms on viscous pressure and heat flow in the transport equations for momentum, energy, viscous pressure and heat flow. The masses and temperatures of the species are arbitrary. An expansion in U is made and the lowest nonvanishing terms are retained. The resulting system is discussed. The nonlinear terms in U may be important even for moderate U. All analytic results were obtained with the symbolic computer language REDUCE. (auth)

269 COMPUTER SIMULATION OF RADIOFREQUENCY CONFINEMENT OF A PLASMA. Shohet, J. L. (Univ. of Wisconsin, Madison). Ann. N. Y. Acad. Sci.; 251: 94-118(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The basic theory of rf confinement is summarized briefly. Single-particle confinement and multiple-particle confinement are treated in separate sections. (MOW)

270 COMPUTER SIMULATION OF ELECTROSTATIC CONFINEMENT OF PLASMAS. Barnes, C. W. (Stanford Univ., CA). Ann. N.Y. Acad. Sci.; 251: 370-379(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Particle-type (Lagrangian) numerical simulation models were used to simulate the electrostatic device in one and two dimensions. The one-dimensional model imposed azimuthal symmetry and constrained the particles to radial flow. With this model, energetic particles had either to pass through the center or form a virtual electrode before reaching the center. A two-dimensional model was used to study angular velocity effects. (MOW)

271 SOLUTION OF A MULTI-LEVEL MODEL OF AN OPTICALLY THICK SODIUM PLASMA. Van Trigt, C.; Blom, N. (Philips Gloeilampenfabrieken N. V., Eindhoven, Netherlands). J. Quant. Spectrosc. Radiat. Transfer; 15: No. 10, 905-917(Oct 1975).

A five level model consisting of the ground state, three excited states (3P, 3D, 4S) and the continuum is solved for an optically thick sodium plasma. Radiation trapping is taken into account and dealt with by means of an eigenfunction technique. (auth)

272 PLASMA EQUILIBRIA WITH CLOSED MAGNETIC FIELD LINES. Teofilo, V. L. New York; New York Univ. (1974). 102p. University Microfilms Order No. 75-9707.

Thesis (Ph. D.).

A general theory of plasma equilibria with closed magnetic field lines is developed for both the MHD and guiding center models. The theory, which imposes reflection symmetry, is applicable to toroidal configurations. However, it does not require an ignorable coordinate as do most toroidal plasma equilibrium calculations which postulate closed magnetic flux surfaces. Under certain conditions related to the spectral structure of the equations of the model, the pressure surface topology is not simple and pressure islands develop. These are distinct from magnetic islands since the magnetic line structure remains closed. The development of these pressure islands, which occurs at a critical value of a parameter, is established in the singular, low beta shallow-well approximation of Taylor and Hastie. In this limit an explicit criterion indicating the appearance of the non-simple pressure contours is derived. The toroidal perturbation and the effect of a vertical field, which in this case do not induce a simple radial shift of the equilibrium, are calculated. Estimates of the pressure island thickness are obtained. (Diss. Abstr. Int., B)

Plasma Production

Refer also to abstract 210.

273 (AD/A-004021) STUDY OF LONG-LIVED RADIATION PROCESSES ASSOCIATED WITH LASER SUPPORTED PLASMAS. Final Report, 15 December 1973-15 September 1974. Allen, J. E. Jr.; Keefer, D. R. (Florida Univ., Gainesville (USA)). 1975. 35p. NTIS $3.75.

An experimental study was made of pulsed laser produced plasmas under various flow conditions. It was hoped that the decay of long lived metastable states could be seen; however, no metastable atoms or molecules were detected. For diatomic gases no molecular species were found, in contrast to results obtained for plasmas produced by continuous wave lasers. Streak and framing photographs were taken and were used to determine plasma structure and absorption wave propagation velocities. (GRA)

274 (AD/A-004585) LASER RADIATION FORCES IN LASER-PRODUCED PLASMAS. Stamper, J. A. (Naval Research Lab., Washington, D.C. (USA)). Dec 1974. 21p. (NRL-MR-2962). NTIS $3.25.

There are two contributions to laser radiation forces acting on the electrons. Transfer of momentum from the fields to the electrons results in a field pressure contribution and occurs whenever there is absorption or reflection. The quiver pressure contribution, associated with electron quiver motion, is due to inhomogeneous fields inducing momentum transfer within the electron system. It is shown that the ponderomotive force does not include the field contribution and does not lead to a general description of macroscopic processes. A theory is discussed which does give a general macroscopic description (absorption, reflection, refraction and magnetic field generation) and which reduces to the ponderomotive force for purely sinusoidal fields in a neutral, homogeneous, nonabsorbing plasma. (GRA)

275 (AD/A-004856) PRODUCTION OF HIGH DENSITY UNIFORM PLASMAS. Final Technical Report. Patrick, R. M. (Avco-Everett Research Lab., Everett, Mass. (USA)). Nov 1974. Contract F44620-70-C-0023. 65p. NTIS $4.25.

See also report dated 30 Nov 1972, AD-755892.

The electron beam sustainer method of generating a stable high pressure gas discharge is investigated experimentally and analyzed theoretically. The important electron loss processes in this type of discharge are recombination and attachment. Electron ion recombination rates have been measured in N_2 and mixtures of He: N_2: CO_2. The effect of electron molecule dissociative attachment on discharge stability is measured experimentally and calculated theoretically. The attachment instability discovered under this program is described and the processes leading to discharge instability and arcing are discussed. (GRA)

276 (PR-29) WILLS PLASMA PHYSICS DEPARTMENT TWENTY-NINTH 6-MONTHLY PROGRESS REPORT, 1ST JANUARY-30TH JUNE 1975. (Sydney Univ. (Australia). School of Physics). 1975. 21p. Dep. NTIS (US Sales Only) $4.25.

Brief descriptions are given of research progress on the following topics: (1) plasma sources, (2) hydromagnetic shock waves, (3) rotating plasmas, (4) magnetohydrodynamics, (5) laser diagnostics, and (6) far-infrared radiation. (MOW)

277 SOME CHARACTERISTICS OF CO_2-LASER-INDUCED MULTIPLE SPARK BREAKDOWN AT PRESSURES UP TO 11 atm. Morrison, R.W.; Swail, C. (Physics Department, Carleton University, Ottawa K1S 5B6, Canada). J. Appl. Phys. 46: No. 9, 3817-3827 (Sept 1975).

A study has been made of the visible breakdown plasma produced by focusing single TEA CO_2 laser pulses 200 nsec wide with salt lenses of 16- and 22-cm focal lengths in argon, helium, neon-helium, and nitrogen at pressures up to 11 atm. Pulse energies ranged from 0.9 to 11 J, with a maximum intensity at the 1-mm focal diameter of 6.6×10^9 W/cm^2. At this incident intensity, well above the breakdown threshold, the main breakdown plasma in argon occurred well upstream of the focus and its multiple structure extended over 5-9 cm. In the focal region only a few isolated sparks were seen. At incident powers closer to threshold, the breakdown occurred closer to, or at, the focus, and migrated upstream toward the laser as the pressure was increased. The spatial structure of the breakdown plasma as seen by time-integrated photography, and the temporal development, monitored by photon drag observations of the transmitted power pulse, were studied with various gases, pressures, and incident pulse energies. A description of the breakdown process is offered which accounts for many of its features, especially the absence of breakdown in the focal region. (auth)

278 X-RAY EMISSION FROM LASER-PRODUCED MAGNESIUM PLASMAS. Lee, T.N.; Nagel, D.J. (Naval Research Laboratory, Washington, D. C. 20375). J. Appl. Phys. 46: No. 9, 3784-3788 (Sept 1975).

Characteristics of x-ray emission produced by focusing a 0.5-GW laser to about 10^{12} W/cm^2 on magnesium metal targets were measured. Approximately 0.01% of the incident laser energy of 10 J was emitted in a 11-nsec (FWHM) pulse of x rays with photon energy in the range 1.3-1.8 keV. (auth)

279 POPULATION INVERSIONS AND THE MEASUREMENT OF GAIN IN LASER-PRODUCED PLASMAS. Silfvast, W.T.; Green, J.M.; Wood, O.R. II (Bell Telephone Laboratories, Holmdel, New Jersey 07733). Phys. Rev. Lett. 35: No. 7, 435-438 (18 Aug 1975).

We consider plasma conditions leading to a population inversion with respect to the ground state of an ion and problems arising in the measurement of gain in laser-produced plasmas. These considerations indicate that recent reports of superradiant emission in a laser-produced aluminum plasma at 117.41 Å might be subject to reinterpretation. (auth)

280 PROPERTIES OF NONNEUTRAL PLASMA. Malmberg, J.H.; deGrassie, J.S. (Department of Physics, University of California, San Diego, La Jolla, California 92037). Phys. Rev. Lett. 35: No. 9, 577-580 (1 Sept 1975).

We describe an apparatus for producing a magnetized column of nonneutral electron plasma which is many Debye lengths in radius. The plasma exhibits the linear and nonlinear electron-wave effects observed in neutralized plasmas. (auth)

281 LARGE, QUIESCENT, MAGNETIZED PLASMA FOR WAVE STUDIES. Gekelman, W.; Stenzel, R.L. (Department of Physics, University of California, Los Angeles, California 90024). Rev. Sci. Instrum. 46: No. 10, 1386-1393 (Oct 1975).

The development of a large magnetized plasma source for wave propagation experiments is described. The method employs a dc discharge in a weak magnetic field region and subsequent particle diffusion into a strong, uniform B-field region. The resultant steady-state plasma is uniform (8 cm$\perp B_0$, 120 cm$\|B_0$), quiescent ($\delta n/n \lesssim 1\%$), has high density ($n_e > 10^{11}$ cm^{-3}), a $B_0 = 1$ kG, argon (3×10^{-4} Torr), and low collision rates ($\nu_m \simeq 10^5$ sec^{-1}). The source can be easily scaled to larger dimensions. Plasma diagnostics with probes, microwaves, and spectroscopy for steady state and afterglow are described. Examples of wave propagation for ion acoustic waves, electron Bernstein waves, and lower hybrid waves indicate the versatility of the device. (auth)

282 PRODUCTION AND FOCUSING OF HIGH-CURRENTS BEAMS OF RELATIVISTIC ELECTRONS UP TO HIGH DENSITIES. Gordeev, A. V.; Korolev, V. D.; Sidorov, Y. L.; Smirnov, V. P. (Inst. of Atomic Energy, Moscow). Ann. N.Y. Acad. Sci.; 251: 668-678(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The results of beam focusing experiments carried out on the "MS" and "Triton" accelerators are presented. The magnetic insulation of vacuum lines is described. Some experiments on beam focusing in the diode gap with a plasma filling are discussed. (MOW)

283 THERMONUCLEAR MICROEXPLOSIONS WITH INTENSE ION BEAMS. Winterberg, F. (Univ. of Nevada, Reno). Ann. N.Y. Acad. Sci.; 251: 679-689(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The generation of intense ion beams in magnetically insulated diodes is discussed. Axial beam compression is described along with the use of ion beams for nuclear microexplosions. Some similarity solutions are given for beam compression. (MOW)

Plasma Stability

284 (AD/A-004129) SHEAR STABILIZATION OF DRIFT WAVES: A NEW APPROACH. Bakshi, P.; Bellew, W. (Boston Coll., Chestnut Hill, Mass. (USA). Dept. of Physics). Sep 1974. Contract F19628-71-C-0079. 29p. NTIS $3.75.

The problem of shear stabilization of drift waves is studied, introducing a new operator method for the solution of the Vlasov equation which allows a more complete determination of the perturbed distribution and density operators. The resulting equations, even when treated in the second order differential equation approximation, lead to modifications in the presently available stability criteria. These methods may prove useful for the study of various instabilities in fusion related confinement systems with strong density and magnetic field variations. (GRA)

285 (AD/A-004593) SATURATION OF THE RELATIVISTIC TWO-STREAM INSTABILITY BY ELECTRON TRAPPING. Lampe, M.; Sprangle, P. (Naval Research Lab., Washington, D. C. (USA)). Dec 1974. 33p. (NRL-MR-2948). NTIS $3.75.

The single-wave weak cold relativistic two-stream instability has been studied in one dimension by numerical integration of the equations of motion, energy conservation, and Poisson's equation. (GRA)

286 (AD/A-004651) HIGH DENSITY CONSTRAINT ON THE ENTROPY INSTABILITY. Hudson, M. K.; Kennel, C. F. (California Univ., Los Angeles (USA). Plasma Physics Group). Dec 1974. Contract N00014-69-A-0200-4050. 18p. (PPG-203). NTIS $3.25.

The entropy instability is a nonisothermal effect which is eliminated by parallel ion pressure at high densities reducing previous growth rate estimates and the range of unstable parameters. (GRA)

287 (CONF-750944-16) NONLINEAR MHD INSTABILITIES IN ELONGATED CYLINDERS. Bateman, G.; Hicks, H. R.; Wooten, J. W. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

From 3rd topical conference on pulsed high beta plasmas; Abingdon, Oxfordshire, UK (9 Sep 1975).

The nonlinear evolution of fixed-boundary instabilities was studied using a 3-D ideal-MHD computer simulation. The effect of elongation and peaked profile is studied. It is found that the dominant process is convection around essentially fixed velocity vortex cells. (auth)

288 (LA-UR--75-1506) NUMERICAL SIMULATION OF THE LOWER HYBRID DRIFT INSTABILITY. Hewett, D. W.; Winske, D. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 5p. (CONF-750944--3). Dep. NTIS $4.00.

From third topical conference on pulsed high beta plasmas; Abingdon, Oxfordshire, UK (9 Sep 1975).

Particle simulations of strongly inhomogeneous plasma phenomena that model theta-pinch behavior in the implosion and post-implosion phases were performed using an inhomogeneous, self-consistent Vlasov equilibrium as an initial state. In the hot ion regime a strong flute instability was observed, whose properties agree well with those predicted by the linear and nonlinear theory of the lower-hybrid-drift instability. (auth)

289 (LA-UR--75-1541) SCYLLAC FEEDBACK STABILIZATION EXPERIMENTS. Cantrell, E. L.; Ellis, W. R.; Freeman, B. L.; Gribble, R. F.; Gutscher, W. D.; Johnson, K. J.; Kutac, K. F.; Miller, G.; Quinn, W. E. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 5p. (CONF-750944--7). Dep. NTIS $4.00.

From third topical conference on pulsed high beta plasmas; Abingdon, Oxfordshire, UK (9 Sep 1975).

For feedback stabilization experiments the magnetic field in a 120^0 sector of the Scyllac torus has been lowered to 17 kG, and the plasma parameters adjusted accordingly to reduce the m equals 1 instability growth rates to values which are compatible with the response time of the feedback system. Initial plasma studies have been completed and compared with MHD sharp-boundary theory. Studies of the effectiveness of l equals 0 and l equals 2 feedback fields are reported. Modifications of the Scyllac feedback stabilization system have resulted in improved reliability, decreased response times, and increased output currents. (auth)

290 (LA-UR-75-1568) NUMERICAL STUDIES OF THE LINEAR THETA PINCH. Brackbill, J. U.; Menzel, M. T.; Barnes, D. C. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 5p. (CONF-750944--11). Dep. NTIS $4.00.

From third topical conference on pulsed high beta plasmas; Abingdon, Oxfordshire, UK (9 Sep 1975).

Aspects of several physical problems associated with linear theta pinches were studied using recently developed numerical methods for the solution of the nonlinear equations for time-dependent magnetohydrodynamic flow in two- and three-dimensions. The problems studied include the propagation of end-loss produced rarefaction waves, the flow produced in a proposed injection experiment geometry, and the linear growth and nonlinear saturation of instabilities in rotating plasmas, all in linear geometries. The studies illustrate how numerical computations aid in flow visualization, and how the small amplitude behavior and nonlinear fate of plasmas in unstable equilibria can be connected through the numerical solution of the dynamical equations. (auth)

291 (LA-UR--75-1577) TIME-DEPENDENT CALCULATIONS OF EQUILIBRIUM AND STABILITY PROBLEMS IN SCYLLAC AND TOKAMAK GEOMETRIES. Brackbill, J. U.; Barnes, D. C. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 5p. (CONF-750944--12). Dep. NTIS $4.00.

From third topical conference on pulsed high beta plasmas; Abingdon, Oxfordshire, UK (9 Sep 1975).

In preparation for a study of the equilibrium and stability properties of Scyllac, a sequence of problems has been studied by numerically solving the MHD equations in three dimensions. Among these are computations of the dynamics of nonequilibrium plasmas in toroidal theta pinches and high beta tokamaks, which illustrate what happens when there is no equilibrium as well as the approach to equilibrium when one exists. The evolution of Kruskal-Shafranov modes in a diffuse screw pinch was also computed from small amplitude to its final nonlinear state. The application of the same method to Scyllac is shown. (auth)

292 (ORNL-tr-4028) HELICAL INSTABILITY OF A PLASMA COLUMN. Zueva, N. M.; Solov'ev, L. S. (AN SSSR, Moscow. Inst. Prikladnoj Matematiki). 1974. Translation by M. Gerrard of Russian preprint No. 89. 10p. Dep. NTIS $4.00.

A linear and nonlinear theory of helical instability for a plasma cylinder is treated in frames of ideal magnetohydrodynamics. The nonlinear stage of the instability growth is considered quasi-statically, i.e., the temporal sequence of states of a system is represented by a chain of properly chosen helical equilibrium configurations. If the states are connected by conservation laws, the system under consideration performs periodical oscillations. A feature of the nonlinear stage of the process consists in formation of magnetic surfaces with a fibrous structure. (auth)

293 (UCRL-Trans-10944) ANISOTROPIC CYCLOTRON INSTABILITY IN THE AS SYSTEM. Zhukovskii, V. G.; Timofeev, A. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Sep 1975. Translation of IAE-2441. 39p. Dep. NTIS $5.00.

Experimental data obtained with the AS system are interpreted in terms of the theory of cyclotron oscillations in a nonuniform magnetic field. According to this theory, the transfer of energy between oscillations and charged particles during cyclotron resonance in a nonuniform magnetic field should be accompanied by the excitation of modulated beams analogous to the van Kampen waves. Modulated beams in the AS system should produce electric fields which are poorly correlated in space, and this was observed

experimentally. Other properties characterizing unstable cyclotron oscillations can be understood in terms of the theory of anisotropic cyclotron instability in a nonuniform magnetic field. (auth)

294 PRODUCTION OF A DOUBLE HUMPED ELECTRON VELOCITY DISTRIBUTION FOR OBSERVATION OF PLASMA INSTABILITIES. Bitter, M.; Paris, P. J. (Ecole Polytechnique Federale, Lausanne (Switzerland)). Z. Angew. Math. Phys.; 25: No. 5, 681-685(25 Sep 1974).

From Swiss Physical Society spring meeting; Bern, Switzerland (26 Apr 1974).

A double humped electron velocity distribution, which is produced by secondary emission of electrons from a fine meshed grid is presented. The distribution can be easily modified by varying the grid potential. Preliminary investigation of the noise spectrum shows that plasma modes of well defined frequencies and wavelengths are driven unstable. (auth)

295 ARC CONSTRICTION IN LAMPS CONTAINING MERCURY AND IODINE. Zollweg, R.J.; Lowke, J.J.; Liebermann, R.W. (Westinghouse Research Laboratories, Pittsburgh, Pennsylvania 15235). J. Appl. Phys. 46: No. 9, 3828-3838 (Sept 1975).

Quantitative calculations indicate that the mechanism by which iodine causes constriction of arcs in mercury vapor lamps is the emission of molecular radiation from HgI. Calculated arc temperature profiles from the energy balance equation for various mixtures of mercury and iodine are found to agree with measured profiles when allowance is made for the emission and self-absorption of radiation from all atomic and molecular species. Approximate emission coefficients for HgI molecular radiation and atomic iodine radiation have been determined as a function of temperature. Molecular radiation emitted from the plasma at temperatures between 2500 and 4500 °K is found to be the major cause of arc constriction for plasma pressures of the order of a few atmospheres. (auth)

296 TEMPORALLY GROWING PARAMETRIC INSTABILITY IN A TURBULENT, INHOMOGENEOUS PLASMA. Yu, M.Y.; Shukla, P.K.; Spatschek, K.H. (Institut für Theoretische Physik, Ruhr-Universität Bochum, D-463 Bochum, Federal Republic of Germany). Phys. Rev. A 12: No. 2, 656-660 (Aug 1975).

The effect of spatial background turbulence on parametric interactions in an infinite, inhomogeneous plasma with a linear density profile is considered. It is shown that the well-known convective saturation arising from the density gradient can disappear in the presence of turbulence. Absolute instability then occurs. The criteria for the existence of temporally growing modes are presented. (auth)

297 OBSERVABILITY AND CONTROLLABILITY OF PLASMA INSTABILITIES. Sen, A.K. (Department of Electrical Engineering and Computer Science and Plasma Research Laboratory, Columbia University, New York, New York 10027). Phys. Fluids 18: No. 9, 1187-1191 (Sept 1975).

Although the questions of whether all the dynamical states are accessible ("observability") and amenable to control ("controllability") play central roles in control science and engineering, these have been completely ignored in the literature of control of plasma instabilities. These problems are discussed and the general conclusion is that any plasma instability of discrete spectrum is completely observable and controllable with a few, but, most often, a single pair of, suitably located point sensor and suppressor. (auth)

298 INSTABILITIES IN TOROIDAL PLASMAS. Pao, Y. (Courant Institute of Mathematical Sciences, New York University, New York, New York 10012). Phys. Fluids 18: No. 9, 1192-1196 (Sept 1975).

Surface-preserving instabilities in axisymmetric toroidal plasmas are studied by a normal-mode analysis. Their growth rates are calculated. Localized instabilities and noncircular diffuse pinches are also examined. (auth)

299 VELOCITY SHEAR DRIVEN INSTABILITIES OF AN UNNEUTRALIZED ELECTRON BEAM. Antonsen, T.M. Jr.; Ott, E. (Department of Electrical Engineering, Cornell University, Ithaca, New York 14853). Phys. Fluids 18: No. 9, 1197-1208 (Sept 1975).

The stability of a planar electron beam with a linear velocity shear both parallel and perpendicular to a fixed, uniform magnetic field is examined. In the case of a beam bounded by conducting walls, an exact criterion for stability is determined for perturbations of arbitrary wavelength. A similar, although more involved, criterion is given for a beam isolated from conducting walls. Estimates of the growth rate of the instabilities are determined for both long and short wavelength perturbations. (auth)

300 STABILITY OF A PLASMA BEAM IN A PERIODIC STRUCTURE. Bogdanov, E.P.; Romanov, Yu.A.; Treoshin, V.M. Sov. Phys.—Tech. Phys. 20: No. 1, 19-23 (July 1975).

The two-stream instability in a periodic structure is analyzed through use of the kinematic approximation for quasistatic waves. (AIP).

301 STABILITY OF DISCONTINUITIES IN A PLASMA. Laptakhov, A. I. (Academy of Sciences of the USSR, Moscow District). Sov. Phys.-Tech. Phys. 20: No. 1, 10-12 (July 1975).

Certain branches of the spectrum of electromagnetic surface waves that propagate along the plane interface between two homogeneous, magnetically active, plasmas can be derived by exploiting the continuity of the tangential components of the electric field at this interface. A system of equations describing such branches of the surface-wave spectrum is derived. The stability of the tangential discontinuity with respect to low-frequency electromagnetic perturbations is analyzed in the cold plasma approximation. (auth)

302 NONLINEAR THEORY OF THE PARAMETRIC DECAY INSTABILITY. Al'terkop, B.A.; Volokitin, A.S. Sov. Phys.—Tech. Phys. 20: No. 1, 86-87 (July 1975).

Parametrically coupled waves are studied in the nonlinear stage of the decay instability when the growth rate exceeds the frequency of the low-frequency of the low-frequency perturbation. In particular, it is shown that the amplitudes of high-frequency waves with a small frequency difference oscillate rapidly about a mean value; in the case of a large frequency difference they vary smoothly, the value being almost equal to the mean value. (auth)

303 ELECTRON ENERGY SPECTRUM OF A PARAMETRICALLY UNSTABLE MAGNETOACTIVE PLASMA. Pasechnik, L.L.; Semenyuk, V.F. (Nuclear Studies Institute, Academy of Sciences of the USSR, Kiev). Sov. Phys.—Tech. Phys. 20: No. 1, 94-95 (July 1975).

It is shown experimentally that the appearance of anomalously fast electrons in the excitation in a plasma of a parametric decay instability is caused by a resonance interaction with the pump wave. The results are in qualitative agreement with ideas on the quasilinear nature of the relaxation of a parametrically unstable plasma. (auth)

304 STABILIZATION OF TRAPPED-PARTICLE MODES BY REVERSED-GRADIENT PROFILES. Tang, W.M.; Rutherford, P.H.; Furth, H.P.; Adam, J.C. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Rev. Lett. 35: No. 10, 660-663 (8 Sept 1975).

Under certain modes of operation of very large tokamaks such as the proposed two-component torus (TCT), it is possible to create oppositely directed density and temperature gradients ($\nabla n \cdot \nabla T < 0$) in the hotter central region of the plasma and the usual profile ($\nabla n \cdot \nabla T > 0$) on the colder outer edge. Such configurations are found to be very favorable to stability against trapped-particle modes. (auth)

305 ANOMALOUS TRANSPORT PROPERTIES ASSOCIATED WITH THE LOWER-HYBRID-DRIFT INSTABILITY. Davidson, R.C.; Gladd, N.T. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Fluids 18: No. 10, 1327-1335 (Oct 1975).

The linear stability behavior and anomalous transport properties associated with the lower-hybrid-drift instability are studied assuming flute-like perturbations with $k \cdot B_0 = 0$. Primary emphasis is placed on the low-drift-velocity regime with $V_E \ll \nu_{Thi}$ (here, V_E is the cross-field electron E×B drift velocity), which pertains to the late stages of implosion and the post-implosion phase of high-density pinch experiments. Nonlinear estimates of the instantaneous heating rates and rate of momentum transfer are made, and the results are studied numerically to determine the parametric dependence on V_E/ν_{Thi} and the level of turbulent field fluctuation energy E_F. It is shown that the lower-hybrid-drift instability can result in substantial resistivity and plasma heating for $V_E \ll \nu_{Thi}$, as well as for the large-drift-velocity regime ($V_E > \nu_{Thi}$). For example, when $T_i/T_e \gg 1$ and $\omega^2_{pe}/\omega^2_{ce} \gg 1$, the bound on anomalous resistivity for $V_E \lesssim \nu_{Thi}$ is $[\eta_{an}]_{max} \simeq 4\pi\sqrt{\pi/2}(V_E/\nu_{Thi})^2 \omega_{LH}/\omega^2_{pe}$ where $\omega_{LH} = (\omega_{pi}\omega_{ce})^{1/2}$ is the lower-hybrid frequency. This large value of resistivity is consistent with observations made during the post-implosion phase of the ZT-1 experiment. (auth)

306 EXPERIMENTAL OBSERVATION OF THE ION-ION BEAM INSTABILITY IN A CYLINDRICAL GEOMETRY. Romesser, T. (Department of Physics and Astronomy, University of Iowa, Iowa City, Iowa 52242); Hershkowitz, N. Phys. Fluids 18: No. 10, 1354-1361 (Oct 1975).

The ion-ion beam instability is investigated in a cylindrical geometry. In the presence of a cylindrically symmetric ion beam a coherent ion-ion beam instability is observed for a well-defined range of beam velocity. This instability gives rise to cylindrical standing waves whose frequency depends upon beam velocity. The beam distribution function is measured to be a ring in velocity space. The dispersion relation appropriate for the cylindrical standing waves is solved numerically and is shown to be in good agreement with the experimentally observed instability. (auth)

307 STABILITY OF A DIFFUSE, HIGH β, $l = 1$ SYSTEM. Berge, G.; Freidberg, J.P. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Fluids 18: No. 10, 1362-1370 (Oct 1975).

A stability analysis for a diffuse high β, $l=1$ helical system is presented. It is shown that there exists a gross $m=1$ mode whose properties are very similar to those predicted by sharp boundary theory. In addition, two new classes of $m = 1$ modes are found. One is a set of interior localized modes and the other a set of modes localized exterior to the plasma. The growth rate of these modes is quite small. The internal mode exists for any monotonic pressure profile and cannot be wall stabilized. Its effect on experimental plasmas is as yet unknown. (auth)

308 RADIAL PLASMA STRUCTURE DURING A THETA-PINCH IMPLOSION: FLUTE INSTABILITIES. McKenna, K.F.; Kristal, R.; Zimmermann, E.L. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Fluids 18: No. 10, 1371-1373 (Oct 1975).

Flute instabilities have been observed during the implosion of an $\simeq 1\times10^{14}$ cm^{-3} initial electron density theta pinch. The flutes occupy only a fraction of the plasma self-luminosity pattern and disappear after formation of the plasma column. The total structure of the luminosity patterns has been correlated with the imploding plasma density and magnetic field distribution. (auth)

309 KELVIN–HELMHOLTZ INSTABILITY OF ANISOTROPIC PLASMA IN A MAGNETIC FIELD. Dahau, S. (Buenos Aires Univ.); Gratton, J. J. Plasma Phys.; 13: 451-479(Jun 1975).

The Kelvin–Helmholtz problem is analyzed by a set of general hydromagnetic equations, which includes ideal magnetohydrodynamic and Chew–Goldberger–Low models as particular cases. A formalism is given that facilitates comparison between results from different models. A sheared flow is one in which the velocity has no component in the y direction, and such that the x and z components of the velocity depend on the y co-ordinate. A sheared field is defined similarly. The differential equations for linear modes of oscillation of a sheared flow in a sheared magnetic field are obtained; and the energy of these modes is studied. As a particular case of oscillations of a sheared flow, the properties of the modes excited by arbitrary modulation of a tangential discontinuity are studied. The relationship between radiation of waves from such a discontinuity and instability of the system is brought out by considering the system energy. Domains of absolute stability are given; and the different hydromagnetic models are compared by examining the predicted domains. It is found that anisotropy plays an important role in the conditions of stability. (auth)

310 ION BEAM ORDINARY ELECTROMAGNETIC MODE INSTABILITY. Gaffey, J. D. (Maryland Univ., College Park). J. Plasma Phys.; 13: 563-569(Jun 1975).

The instability of the ordinary mode propagating perpendicular to the magnetic field is discussed for two ion beams counter-streaming along the magnetic field through a plasma of stationary electrons and ions. The instability criterion gives the necessary and sufficient condition for a purely growing mode. Although the instability threshold is high ($u/V_{OI} \gtrsim (2\beta_{OI}N_{bI}/N_{OI})^{-\frac{1}{3}}$ if the streaming velocity is 10% larger than the threshold value), large growth rates of the order of the ion cyclotron frequency result. (auth)

311 HIGH SPEED PHOTOGRAPHIC STUDIES OF THE EQUILIBRIUM AND STABILITY ON THE ATC TOKAMAK. Jacobsen, R. A. (Princeton Univ., NJ). Plasma Phys.; 17: No. 7-8, 547-554(Jul 1975).

High speed photographic studies of the equilibrium and stability of the ATC Tokamak have been performed. Framing speeds of 26,000 pictures per sec were achieved as were effective shuttering times of 5μ sec. Streak photography with time resolution of 15μ sec was also performed. Studies of the disruptive instability enabled the radial expansion velocity of the plasma cross section to be determined as $V \sim 0.1B_p/B_T\tau_0$. Differences in the form of the negative spike on the loop voltage between disruptions which led to the plasma interacting with the limiter and those which did not where found. A histogram giving the relative occurrence of disruptive instabilities vs the q of the plasma just before the disruption was constructed. This showed that disruptions occurred for $1.4 \leq q \leq 2.9$ with the majority of events occurring for $q \sim 2$. (auth)

312 SATURATION OF ABSOLUTE BEAM-PLASMA INSTABILITY BY BEAM TRAPPING. Carr, W.; Jones, R.; Seidl, M. (Stevens Inst. of Tech., Hoboken, NJ). Plasma Phys.; 17: No. 7-8, 623-627(Jul 1975).

The first experimental observation of saturation of the absolute instability due to beam trapping is reported. The details of the trapping differ from the convectively unstable case in that the wave is large near the electron gun, and the beam is suddenly trapped in the large amplitude wave. The experimental results are in agreement with a calculation of the nonlinear beam dynamics, based on the trapping model, but modified to include a backward plasma wave. (auth)

313 COLLECTIVE ION ACCELERATION VIA THE TWO-STREAM INSTABILITY. Godfrey, B. B.; Thode, L. E. (Los Alamos Scientific Lab., NM). Ann. N.Y. Acad. Sci.; 251: 582-589(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Microinstabilities associated with a cold, low nu/gamma, intense relativistic electron beam passing through a cold underdense ion background are studied. A one-dimensional homogeneous model is assumed. A restriction was made to the relativistic electron-ion longitudinal two-stream instability. (MOW)

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Refer also to abstracts 181, 423, 430, and 1097.

314 (AD/A-003460) INTERACTIONS OF RELATIVISTIC ELECTRON BEAMS WITH HIGH-ATOMIC-NUMBER PLASMAS. Mosher, D. (Naval Research Lab., Washington, D. C. (USA)). Dec 1974. 49p. (NRL-MR-2959). NTIS $3.75.

A relativistically correct Fokker–Planck analysis is used to develop fluid equations which model the interaction of relativistic electron beams with high atomic-number plasmas. The derived collision terms can be used to describe scattering and energy in materials ranging from the solid to high-temperature plasma forms. The full set of equations discussed can be used to study electron-beam-initiated pellet-fusion in a completely self-consistent fashion. Specifically, the model is applicable to study of beam pinching in plasma-filled diodes, the interaction of focussed beams with target plasmas, and the transport of high ν/γ beams in high atomic-number plasmas. Although the general equations are amenable to solution only by computational techniques, analytic solutions describing the time-dependent, collisional interaction of a beam in an infinite plasma, and the one-dimensional equilibrium of a beam in a plasma with applied electric field have been obtained. (GRA)

315 (AED-CONF-75-043-031) JET: THE JOINT EUROPEAN TOKAMAK EXPERIMENT. Noll, P. (UKAEA Research Group, Abingdon. Culham Lab.). 1975. 21p. INIS.

From spring meeting of the Fachausschuesse Kurzzeitphysik and Plasma- und Gasentladungsphysik of the DPG; Duesseldorf, F. R. Germany (4 Mar 1975).

The various national research laboratories in the European Community working in the field of controlled nuclear fusion have recently started the preparations for a major experiment which is known as "Joint European Torus" (JET). The magnetic configuration is the same as in the Tokamak. In the present paper, (a) the Tokamak principle is explained, (b) the research aims are stated in detail, (c) the experimental apparatus is described, and (d) the main physical problems are listed. Furthermore, the research aims are compared with those of the worldwide Tokamak program. (GE)

316 (BNL-20076) NONSTEADY HEAT CONDUCTION CODE WITH RADIATION BOUNDARY CONDITIONS. Fillo, J. A.; Benenati, R.; Powell, J. (Brookhaven National Lab., Upton, N.Y. (USA)). 1975. 37p. (CONF-751106-1). Dep. NTIS $5.00.

From annual meeting of ASME; Houston, Texas, USA (30 Nov 1975).

A heat-transfer model for studying the temperature build-up in graphite blankets for fusion reactors is presented. In essence, the computer code developed is for two-dimensional, nonsteady heat conduction in heterogeneous, anisotropic solids with non-uniform internal heating. Thermal radiation as well as bremsstrahlung radiation boundary conditions are included. Numerical calculations are performed for two design options by varying the wall loading, bremsstrahlung, surface layer thickness and thermal conductivity, blanket dimensions, time step and grid size. (auth)

317 (BNL-20286) APPLICATION OF CONTROLLED THERMONUCLEAR REACTOR FUSION ENERGY FOR FOOD PRODUCTION. Dang, V. D.; Steinberg, M. (Brookhaven National Lab., Upton, N. Y. (USA)). Jun 1975. 52p. (CONF-751107-7). Dep. NTIS $5.75.

From 68th annual meeting of American Institute of Chemical Engineering; Los Angeles, California, USA (16 Nov 1975).

Food and energy shortages in many parts of the world in the past two years raise an immediate need for the evaluation of

energy input in food production. The present paper investigates systematically (1) the energy requirement for food production, and (2) the provision of controlled thermonuclear fusion energy for major energy intensive sectors of food manufacturing. Among all the items of energy input to the "food industry," fertilizers, water for irrigation, food processing industries, such as beet sugar refinery and dough making and single cell protein manufacturing, have been chosen for study in detail. A controlled thermonuclear power reactor was used to provide electrical and thermal energy for all these processes. Conceptual design of the application of controlled thermonuclear power, water and air for methanol and ammonia synthesis and single cell protein production is presented. Economic analysis shows that these processes can be competitive. (auth)

318 (BNWL-SA-5488) ENVELOPE OF CURRENT CTR POWERPLANT DESIGN CHARACTERISTICS. Gore, B. F. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. 6p. (CONF-751101-33). Dep. NTIS $4.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

An envelope of characteristics of the ten current U. S. design concepts for D-T fueled CTR powerplants is presented. Designs based upon both magnetic and inertial plasma confinement are included. This envelope has been defined for reference in environmental and economic analyses of the effects of extensive generation of electric power by CTR powerplants. (auth)

319 (CEA-CONF-3102) ANNULAR DUOPIGATRON AND THE DIRECT RECOVERY OF THE CHARGED BEAM FRACTION. Fumelli, M.; Valckx, F. P. G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). 1974. 3p. (CONF-741019-14). Dep. NTIS (US Sales Only) $4.00.

From symposium on ion sources and formation of ion beams; Berkeley, California, USA (22 Oct 1974).

An annular type duopigatron is studied for the production of high power, long duration neutral beams. The main advantage of this source is its high degree of homogeneity of the plasma density. Experiments are going on to increase the extracted current above the actual value of 2 A, which corresponds to a current density of 100 mA/cm^2, and to prolong the pulse duration from 0.5 sec to higher values. The source is operated at ground potential. A large area multi-aperture three-electrode extraction system is used. The neutraliser (a hydrogen gas cell adjacent to the extraction system where the accelerated ions are partially converted into fast atoms by charge exchange and dissociation) is biased at the negative potential corresponding to the desired beam energy. At the exit of the neutraliser there exists in this disposition a strong electric field which decelerates the energetic ions remaining in the beam. This field removes the charged fraction from the beam; furthermore it is possible to provide for the energy recovery of this fraction. Preliminary results of the energy recovery with a He-beam are given. (auth)

320 (CLM-R-136) NEUTRONICS OF CELLULAR BLANKETS FOR FUSION REACTORS. Constantine, G.; Bengston, J. J.; Samuelson, H. H. (UKAEA Research Group, Abingdon, Culham Lab.). 1975. 20p. Dep. NTIS (US Sales Only) $4.00. UK pounds 1.00.

Early models of a fusion reactor blanket based on a toroidal first wall backed by liquid lithium can be quickly discounted because of the impossibility of maintenance and repair. A more practical engineering solution was proposed in which the blanket comprises replaceable cylindrical cells in a close nested array. This paper examines the neutronic consequences in terms of increased neutron leakage from the blanket and breeding losses due to the cusp shaped gaps between these cells. (auth)

321 (COO--2272-10) PROPOSAL TO THE UNITED STATES ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION FOR CONTINUATION OF FUSION REACTOR TECHNOLOGY STUDIES. Progress Report, 1 August 1974--30 April 1975. Conn, R. W.; Kulcinski, G. L.; Maynard, C. W. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). 1975. 25p. Dep. NTIS $4.25.

A brief report of research progress is given for the following areas: (1) completion of UWMAK-I "balance of plant" design, (2) UWMAK-II reactor design, (3) the carbon curtain concept, (4) the Internal Spectral Shifter and Energy Converter (ISSEC) blanket design concept as a method to minimize the radiation damage to CTR first walls from D-T neutrons, (5) beam driven tokamak studies, (6) plasma wall experiments, (7) neutron cross section measurements for the production of long lived radioisotopes, H, and He atoms, and (8) experimental testing of magnet conductor design. (MOW)

322 (INIS-mf-1698, pp 223-229) USING CYCLOTRONS FOR MEASURING NEUTRON CONSTANTS OF THERMONUCLEAR RANGE. Venikov, N. I.; Ogloblin, A. A.; Yudin, L. I. 1974. (In Russian).

From 2nd all-union conference on neutron physics: Obninsk, USSR (3 Mar 1974).

In Neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A look is taken at a number of possibilities for using an isochronous cyclotron as a source of quasienergetic neutrons and neutrons with a continuous spectrum. Supplementary devices are described by means of which it is possible to obtain such neutron beams on a cyclotron. A look is also taken at the technique of measuring the time characteristics of the beam, and a suitable method is proposed for increasing the efficiency of using the cyclotron as a source of monoenergetic neutrons. (tr-SJR)

323 (LA-5966-P) PROPOSAL FOR THE CONSTRUCTION OF THE STAGED SCYLLAC PROTOTYPE. Nunnally, W. C.; McDonald, T. E. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1975. 43p. Dep. NTIS $4.00.

After the completion of the present feedback experiment on Scyllac, the machine will be reconfigured into a toroidal staged theta pinch. A 0.9-m prototype of the Staged Scyllac experiment is proposed which will be used to test the components required for the implosion-heating and staging circuits in a system environment. In addition, various systems of the Staged Scyllac, such as the trigger system and the gap-monitoring system, can be developed on the prototype before installation on the full experiment. (auth)

324 (LA-6046-MS) PREHEAT EFFECTS ON MICROBALLOON LASER FUSION IMPLOSIONS. Fraley, G. S.; Mason, R. J. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1975. 5p. Dep. NTIS $4.00.

Nonequilibrium hydroburn simulations of early laser-driven compression experiments indicate that low energy photons from the vicinity of the ablation surface are preheating the microballoon-pushers, thereby severely limiting the compressions achieved (similar degradation may result from 1 to 4 percent energy deposition by superthermal electrons). This implies an 8- to 27-fold increase in the energy requirements for breakeven, unless radiative preheat can be drastically reduced by, say, the use of composite ablator-pushers. (auth)

325 (LA-6079-MS) STRUCTURE AND SCALING LAWS OF LASER-DRIVEN ABLATIVE IMPLOSIONS. Gitomer, S. J.; Morse, R. L.; Newberger, B. S. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1975. Contract W-7405-eng-36. 3p. Dep. NTIS $4.00.

A stationary, spherical flow model gives the form of laser-driven ablation fronts and scaling laws for the dependence of implosion parameters on laser wavelength, pusher atomic number, and other input quantities. (auth)

326 (LA-UR--75-1502) SCYLLAC FUSION TEST REACTOR DESIGN. Linford, R. K.; Oliphant, T. A.; Thomassen, K. I. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 5p. (CONF-750944--8). Dep. NTIS $4.00.

From third topical conference on pulsed high beta plasmas; Abingdon, Oxfordshire, UK (9 Sep 1975).

The SFTR is a proposed 80-m diameter D-T burning toroidal theta pinch. The system is designed to achieve Q equals 1 where Q is the ratio of the total thermonuclear energy output to the maximum stored energy in the plasma. SFTR design studies will provide valuable guidance to the Scyllac related research and to the needed technological development. This paper describes the portion of the system directly related to the plasma confinement, stability, and heating, and outlines the approach used to obtain an operating point consistent with Q equals 1, m equals 1 stability, and technological limitations. (auth)

327 (LA-UR--75-1566) LINEAR THETA PINCH AS A 14-MeV NEUTRON SOURCE. Ellis, W. R. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 6p. (CONF-750944-2). Dep. NTIS $4.00.

From third topical conference on pulsed high beta plasmas; Abingdon, Oxfordshire, UK (9 Sep 1975).

A linear theta pinch is considered as the neutron source in a Fusion Engineering Research Facility (FERF). The device is optimized parametrically for maximum 14-MeV neutron flux through a test sample located between the discharge tube and the compression coil wall. A flux of approximately 10^{14}n/cm^2/s can be achieved through a test-sample volume of 6.5 liters in a device 1.7 m long with a 150-kG magnetic field, 2:1 mirrors (300 kG) at the ends, a discharge frequency of 1.9 kHz, and a rotating-machinery power supply. (auth)

328 (LA-UR--75-1567) HYBRID MODEL STUDIES OF MAGNETIC FIELD DIFFUSION IN HIGH-BETA PINCHES. Sgro, A. G.; Nielson, C. W. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 5p. (CONF-750944--13). Dep. NTIS $4.00.

From third topical conference on pulsed high beta plasmas; Abingdon, Oxfordshire, UK (9 Sep 1975).

A hybrid model was derived which includes all nontrivial field components and an anisotropic anomalous resistivity. It was applied to the ZT-1 reverse field diffuse pinch. For a proper choice of anomalous resistivity, the calculated and observed fields are in good agreement. Impurities are found to cause the plasma to implode to a smaller radius and to result in lower electron temperatures and higher ion temperatures. (auth)

329 (LA-UR-75-1801) CTR RELATED TRITIUM RESEARCH AT LASL. Anderson, J. L.; Carstens, D. H. W.; Alire, R. M. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 22p. (CONF-751026-5). Dep. NTIS $4.25.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (1 Oct 1975).

The solubility and diffusion coefficients of H_2 in Li contained in a cylinder of Nb/1 percent Zr were measured in the temperature range 805-905^{0}C at a pressure of 575 Pa. Appropriate corrections for the solubility of H_2 in Nb/1 percent Zr were made. As expected, a finite solid cylinder diffusion model adequately delineates the time-dependent consumption of H_2 in Li. The diffusion coefficient was found to vary from 3.88×10^{-5} to 6.92×10^{-5} cm^2/sec and the activation energy was estimated to be 14.7 kcal/mole. The use of low melting eutectic mixtures containing Y, La, and Ce for extracting tritium from molten lithium is being investigated. Eutectic mixtures being investigated include the 16 percent in La, 12 percent Fe in Ce and 16 percent Co in Ce. At 875^{0}K the molar distribution coefficients for tritium between these eutectic mixtures and lithium are less than or equal to 100. The temperature coefficients for these distributions are also being investigated. The pressure-composition-temperature diagram for the La_2Ni-deuterium system is being studied. A DELTA H of -39.7 kcal/mole D_2 was measured for the composition D/La 1.5. (auth)

330 (LA-UR-75-1813) HIGH ENERGY PROTON SIMULATION OF 14-MeV NEUTRON DAMAGE IN Al_2O_3. Muir, D. W.; Bunch, J. M. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 17p. (CONF-751026-3). Dep. NTIS $4.00.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (1 Oct 1975).

High-energy protons are a potentially useful tool for simulating the radiation damage produced by 14-MeV neutrons in CTR materials. A comparison is given of calculations and measurements of the relative damage effectiveness of these two types of radiation in single-crystal Al_2O_3. The experiments make use of the prominent absorption band at 206 nm as an index to lattice damage, on the assumption that peak absorption is proportional to the concentration of lattice vacancies. The induced absorption is measured for incident proton energies ranging from 5 to 15 MeV and for 14-MeV neutrons. Recoil-energy spectra are calculated for elastic and inelastic scattering using published angular distributions. Recoil-energy spectra also are calculated for the secondary alpha particles and ^{12}C nuclei produced by (p,p' alpha) reactions on ^{16}O. The recoil spectra are converted to damage-energy spectra and then integrated to yield the damage-energy cross section at each proton energy and for 14 MeV neutrons. A comparison of the calculations with experimental results suggests that damage energy, at least at high energies, is a reasonable criterion for estimating this type of radiation damage. (auth)

331 (LA-UR-75-1840) NEUTRON IRRADIATION DAMAGE IN Al_2O_3 AND Y_2O_3. Clinard, F. W. Jr.; Bunch, J. M.; Ranken, W. A. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 22p. (CONF-751026-1). Dep. NTIS $4.25.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (1 Oct 1975).

Two ceramics under consideration for use in fusion reactors, Al_2O_3 and Y_2O_3, were irradiated in the EBR-II fission reactor at 650, 875, and 1025^{0}K to fluences between 2 and 6×10^{21} n/cm^2 (E greater than 0.1 MeV). Samples evaluated include sapphire, Lucalox, alumina, Y_2O_3, and Y_2O_3-10 percent ZrO_2 (Yttralox). All Al_2O_3 specimens swelled significantly (1 to 3 percent), with most of the growth observed in sapphire along the c-axis at the higher temperatures. Al_2O_3 samples irradiated at 875 to 1025^{0}K contained a high density of small aligned "pores". Irradiated Y_2O_3-based ceramics exhibited dimensional stability and a defect content consisting primarily of unresolved damage and/or dislocation loops. The behavior of these ceramics under irradiation is discussed, and the relevance of fission neutron damage studies to fusion reactor applications is considered. (auth)

332 (MATT--1155) TOKAMAK ENGINEERING TEST REACTOR. Conn, R. W.; Jassby, D. L. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jul 1975. Contract E(11-1)-3073. 36p. Dep. NTIS $5.00.

The design criteria for a tokamak engineering test reactor can be met by operating in the two-component mode with reacting ion beams, together with a new blanket-shield design based on internal neutron spectrum shaping. A conceptual reactor design achieving a neutron wall loading of about 1 MW/m^2 is presented. The tokamak has a major radius of 3.05 m, the plasma cross-section is noncircular with a 2:1 elongation, and the plasma radius in the midplane is 55 cm. The total wall area is 149 m^2. The plasma conditions are T/sub e/ approximately T/sub i/ approximately 5 keV, and n tau approximately 8×10^{12} cm^{-3}s. The plasma temperature is maintained by injection of 177 MW of 200-keV neutral deuterium beams; the resulting deuterons undergo fusion reactions with the triton-target ions. The D-shaped toroidal field coils are extended out to large major radius (7.0 m), so that the blanket-shield test modules on the outer portion of the torus can be easily removed. The TF coils are superconducting, using a cryogenically stable TiNb design that permits a field at the coil of 80 kG and an axial field of 38 kG. The blanket-shield design for the inner portion of the torus nearest the machine center line utilizes a neutron spectral shifter so that the first structural wall behind the spectral shifter zone can withstand radiation damage for the reactor lifetime. The energy attenuation in this inner blanket is 8×10^{-6}. If necessary, a tritium breeding ratio of 0.8 can be achieved using liquid lithium cooling in the outer blanket only. The overall power consumption of the reactor is about 340 MW(e). A neutron wall loading greater than 1 MW/m^2 can be achieved by increasing the maximum magnetic field or the plasma elongation. (auth)

333 (MATT-1161) REACTOR APPLICATIONS OF TWO-COMPONENT TOKAMAK PLASMAS. Tenney, F. H. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Oct 1975. Contract E(11-1)-3073. 20p. Dep. NTIS $4.00.

The physics of two-energy-component toroidal plasmas (TCT) is reviewed. Energy "breakeven" using the TCT mode (deuteron beams on a triton-target plasma) can be attained at much smaller n tau and temperature than in thermal plasma operation. This result reflects the fact that the fusion power density in a TCT can be much larger than in a thermal DT plasma of the same pressure. The large fusion power density (i.e., large neutron flux) of a TCT may find practical use in a number of applications. (auth)

334 (N-75-15458) TIME-DEPENDENT OUTGASSING AND IMPURITIES IN THE NASA LEWIS BUMPY TORUS. Persson, H. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). 31 Oct 1974. 9p. (NASA-TM-X-71639; E-8191; CONF-741079-19). NTIS $3.25.

From 16th annual meeting of the plasma physics division of the American Physical Society; Albuquerque, New Mexico, USA (28 Oct 1974).

To investigate the importance to fusion devices of desorption of gas from walls or cryosurfaces under long time operation, preliminary mass spectrometric investigations were carried out on the NASA Lewis Bumpy Torus with a 0.1–2A discharge in D2 at a pressure of 4.0 to 6.6 x 0.00001 torr. During the initial tens of minutes of discharge operation large quantities of a component with mass number 28, believed to be nitrogen, were released. The decrease with time of the nitrogen density after its initial maximum indicated a diffusion controlled outgassing from cryodeposits or wall material. When cold surfaces were allowed to warm up, large quantities of gas were released. The integrated amount of N2 was typically the same as that released during a discharge, while the amount of H_2O was orders of magnitude larger. (auth)

335 (ORNL-5082) CONTROLLED THERMONUCLEAR MATERIALS TECHNOLOGY PROGRAM. Annual Progress Report for Period Ending June 30, 1975. Scott, J. L. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 87p. Dep. NTIS $5.45.

Detailed descriptions are given of research progress in the following areas: (1) microstructure of irradiated 316 stainless steel containing high helium concentrations, (2) temperature and fluence limitations for a type 316 stainless steel CTR first wall, (3) swelling and microstructural changes in irradiated vanadium alloys, (4) mechanical properties of irradiated V-20 wt percent Ti, (5) radiation damage calculations, (6) evaluation of irradiation facilities for CTR materials development, (7) surface studies,

compatibility studies, (8) magnet development, (9) EPR design support, and (10) the influence of structural materials on fusion-reactor blanket response. (MOW)

336 (ORNL-TM-4981) REDUCTION OF NEUTRAL PARTICLES REFLUXING INTO A PLASMA BY USE OF A HONEYCOMB WALL. Cramer, S. N.; Oblow, E. M. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. 17p. Dep. NTIS $4.00.

The feasibility of honeycombing the first wall of a fusion reactor was investigated with regard to refluxing of neutral particles back into the plasma. The effect of the length-to-diameter ratio (L/D) of the honeycomb cell on the energy and angular distribution of refluxed particles was studied as well as the ratio of the refluxing from honeycomb and smooth walls. Honeycombing the wall with an L/D equals 1.5 cell was found to typically reduce the number of refluxed particles by a factor of 10 compared to a smooth wall. In addition, the total energy refluxing was reduced to approximately 6 percent of the comparable smooth wall value. The effect of the honeycomb on the emerging angular distribution of refluxed particles was minimal in the optimum honeycomb configuration (L/D from 1.0 to 2.0). (auth)

337 (SAND--75-5691) ELECTRON BEAM FUSION TARGETS. Sweeney, M. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). 12 Sep 1975. 17p. (CONF-750943--1). Dep. NTIS $4.00.

From conference of the department of physics and astronomy; Albuquerque, New Mexico, USA (12 Sep 1975).

Focused relativistic electron beams are receiving considerable attention as a means of imploding spherical targets a few millimeters in diameter to produce substantial thermonuclear yields. A central consideration of such proposals is the design of the targets and, in particular, design calculations which concentrate on reducing breakeven power levels. The behavior of e-beam fusion targets in which a low-Z (iron or carbon) ablator surrounds a high-Z, high-density (gold) pusher is compared to that of single gold shell targets. Both types of DT-filled targets are irradiated by constant-power 1-MeV electron beam pulses. The use of a low-Z ablator decreases the bremsstrahlung heating of the pusher. The resulting colder and denser pusher is more effective. Breakeven requires about 360 TW of power deposited for 8 ns with iron ablators; 220 TW deposited for 12 ns with high-density (3.52 g/cm^3) carbon ablators. This is less than half the power required for targets composed of a single DT-filled gold shell (800 TW deposited for 5 ns). (auth)

338 (UCRL--51872) DESIGN OF A REPETITIVELY PULSED MEGAJOULE DENSE-PLASMA FOCUS. Zucker, O.; Bostick, W.; Gullickson, R.; Long, J.; Luce, J.; Sahlin, H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Aug 1975. Contract W-7405-Eng-48. 58p. Dep. NTIS $5.45.

This report describes a 1 pulse per second, dense-plasma-focus (DPF) materials-testing device capable of delivering a minimum of 10^{15} neutrons per pulse. Moderate scaling up from existing designs is shown to be sufficient to provide 2 x 10^{13} neutrons/cm^2. s to a suitable target. The average power consumption, which has become a major issue due to the energy crisis, is analyzed with respect to other plasma devices and is shown to be highly favorable. Also discussed is a novel approach to capacitor-bank and switch design with respect to repetitive-pulse operation. (auth)

339 (UCRL-76639) LENS AND MIRROR DESIGN VIA THE PRINCIPAL SURFACE. Greenbaum, A.; Glass, A. J.; Trenholme, J. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Jul 1975. 19p. (CONF-750679-1). Dep. NTIS $4.50.

From international lens design conference; Haverford, Pennsylvania, USA (26 Jun 1975).

The problem of optical design is stated as follows: Given a principal surface r(alpha), and a maximum focal angle alpha/sub m/, find the pair of optical surfaces for which diffraction limited focusing is achieved. It is shown that specification of r(alpha) and alpha/sub m/ uniquely determines the lens design to within a scale factor, given the refractive index of the lens. It is further shown that one straightforward Runge-Kutta integration routine generates both surfaces for either a lens or a pair of mirror surfaces. The complete family of aplanatic lenses is described. Deviation from sphericity is discussed, as well as the possibility of realizing the specified lens designs. The family of lenses which map uniform incident intensity into uniform illumination about the focus is also described. Extension of the method to off-axis aberrations is considered. (auth)

340 (UCRL-77055) FUSION POWER: THE TRANSITION FROM FUNDAMENTAL SCIENCE TO FUSION REACTOR ENGINEERING. Post, R. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Jul 1975. 42p. (CONF-750948-1). Dep. NTIS $5.25.

From IEEE Eascon meeting; Washington, District of Columbia, USA (29 Sep 1975).

The historical development of fusion research is outlined. The basics of fusion power along with fuel cost and advantages of fusion are discussed. Some quantitative requirements for fusion power are described. (MOW)

341 POLOIDAL FIELD MEASUREMENTS IN THE ST TOKAMAK BY HARMONIC GENERATION AT THE UPPER HYBRID LAYER. Cano, R.; Fidone, I.; Hosea, J.C. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Fluids 18: No. 9, 1183-1186 (Sept 1975).

An extraordinary incident wave propagating along the major radius through the ST tokamak plasma is used to generate a second harmonic wave at the upper hybrid layer. Remote polarization measurements of the harmonic yield the poloidal magnetic field profile. The estimated over-all error in the measurement of the rotation angle of the total magnetic field is $\simeq 0.3\times10^{-2}$ rad. Further improvements in the accuracy of the measurements which are required to specify the current density profile unambiguously are discussed. (auth)

342 CRITICAL-DENSITY SCALE-LENGTH MEASUREMENTS IN LASER-PRODUCED PLASMAS. Jackel, S.; Albritton, J.; Goldman, E. (Laboratory for Laser Energetics, College of Engineering and Applied Sciences, University of Rochester, Rochester, New York 14627). Phys. Rev. Lett. 35: No. 8, 514-517 (25 Aug 1975).

Inhomogeneity scale lengths between critical and quarter-critical densities have been obtained by photographing laser-produced plasmas in emitted light at twice and three-halves the laser frequency. The displacements of the harmonic-light images were measured on photographs taken from a position below spherical targets irradiated by four Nd:glass-laser beams. Over the range of 5 to 20 J absorbed (in 200 to 600 psec) by 70–100-μm-diam glass shells, this scale length increased linearly from 10 to 30 μm. (auth)

343 PREHEAT EFFECTS ON MICROBALLOON LASER-FUSION IMPLOSIONS. Fraley, G.S.; Mason, R.J. (Theoretical Division, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87544). Phys. Rev. Lett. 35: No. 8, 520-523 (25 Aug 1975).

Nonequilibrium hydro-burn simulations of early laser-driven-compression experiments indicate that low-energy photons from the vicinity of the ablation surface are preheating the microballoon pushers, thereby severely limiting the compression achieved (similar degradation may result from 1–4% energy deposition by superthermal electrons). This implies an 8- to 27-fold increase in the energy requirements for breakeven, unless radiative preheat can be drastically reduced by, say, the use of composite ablator pushers. (auth)

344 THE USE OF ELECTRONIC SPACE CHARGE TO ACCELERATE, FOCUS, AND BUNCH IONS FOR PELLET FUSION. Verdeyen, J.T.; Swanson, D.A.; Cherrington, B.E.; Johnson, W.L. (Gaseous Electronics Laboratory, Department of Electrical Engineering, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). Appl. Phys. Lett. 27: No. 7, 380-382 (1 Oct 1975).

Theoretical arguments are presented which show that electronic space charge can transfer large amounts of energy to ions while simultaneously focusing and bunching their arrival at a small pellet. (auth)

345 MODEL FOR THE PRODUCTION AND TRANSPORT OF ENERGETIC PARTICLES IN A LASER PRODUCED PLASMA. Manheimer, W.M.; Klein, H.H. (Naval Research Laboratories, Washington, D.C. 20375). Phys. Fluids 18: No. 10, 1299-1307 (Oct 1975).

A model is presented for the production and transport of energetic electrons in a laser produced plasma. The basic assumption is that the laser deposits its energy in the form of a large amplitude plasma wave. The energy is given to particles as the electrostatic wave propagates outward and damps. Theory and simulations show that the maximum energetic particle velocity is between about five and seven thermal velocities, and that the heat flux is limited to about (1/4) nmV_{ϕ}^3. (auth)

346 DYNAMIC ACCESSIBILITY OF TOROIDAL BELT PINCH EQUILIBRIA. Kadish, A. (New York Univ., NY). Plasma Phys.; 17: No. 7-8, 555-565(Jul 1975).

Topological constraints on the motion of finite toroidal systems are employed to show that most force-free field configurations in a belt pinch geometry are not dynamically accessible via an adiabatic compression of force-free fields. This result is independent of any stability considerations. The leading asymptotic term (in the ratio column width/column height), for equilibria which are accessible via a radial motion, is determined by requiring that poloidal flux surfaces must also be poloidal current surfaces. As an application, it is shown that if the belt pinch column is a uniform, $\beta = 1$ column, surrounded by a force-free field region, then near the interface the magnitude of the poloidal magnetic field is a decreasing function of the poloidal flux, and toroidal currents in the sheath and neighbouring force-free field region are opposed. Moreover, near the toroidal midplane, both

inner and outer portions of the interface have similarly directed radial velocities. (auth)

347 PRODUCTION AND CONFINEMENT OF HIGH-DENSITY PLASMAS. Bostick, W. H.; Nardi, V.; Prior, W. (Stevens Inst. of Tech., Hoboken, NJ). Ann. N.Y. Acad. Sci.; 251: 2-29(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The following topics are described: (1) the current sheath in a coaxial accelerator, (2) fine structure of the current sheath, (3) electron densities and structure in localized regions of high-density plasmas, and (4) neutron emission data. (MOW)

348 THEORETICAL ASPECTS OF COLLECTIVE ION ACCELERATION IN RELATIVISTIC ELECTRON BEAM DEUTERATED POLYETHYLENE TARGET INTERACTION. Sahlin, H. L. (Univ. of California, Livermore). Ann. N. Y. Acad. Sci.; 251: 238-272 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The principal objective of this research has been to develop a 1-MJ plasma focus, which when operated in a low-density mode is expected to produce 10-nsec, 5-MA small diameter relativistic electron bursts. They will be used in fusion microexplosion studies to heat and compress solid targets in an effort to obtain significant thermonuclear yield. Some results on deuterated polyethylene are presented. (MOW)

349 NEUTRON PRODUCTION WITH HIGH-CURRENT RELATIVISTIC ELECTRON BEAMS AND DEUTERATED POLYETHYLENE TARGETS. Clark, J. G. (Kirtland Air Force Base, Albuquerque, NM); Kerns, J. R.; McCann, T. E. Ann. N. Y. Acad. Sci.; 251: 273-293(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The direction of an intense relativistic electron beam by the utilization of a Bennett cathode has made possible experiments to exploit these extremely powerful energy sources for thermonuclear fusion. Some initial experiments yielded up to 4×10^7 neutrons, when a small pellet of deuterated polyethylene was inserted in the beam path of an electron beam machine. Later experiments used deuterated cathode tips in such a way that collectively accelerated ions contribute to the neutron yield through a beam–target interaction. Experimental results and the theoretical analysis of that data are reported. (MOW)

350 AUTOACCELERATION OF AN INTENSE RELATIVISTIC ELECTRON BEAM. Friedman, M. (Naval Research Lab., Washington, DC). Ann. N. Y. Acad. Sci.; 251: 294-311(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The conditions for effective autoacceleration of a relativistic electron beam are discussed. The autoacceleration processes are the result of the mutual interaction between the electron beam and passive structures which are inserted in a conventional drift tube. This interaction leads to the redistribution of energy within the beam such that the majority of the electrons transfer their energy to only a small portion of the beam. (MOW)

351 ELECTRON BEAM STORAGE DEVICES FOR CONTROLLED FUSION. Clark, W. (Maxwell Labs., Inc., San Diego, CA); Korn, P.; Mondelli, A.; Rostoker, N. Ann. N.Y. Acad. Sci.; 251: 568-581(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The following topics are briefly discussed: (1) electrical energy storage: current status, (2) confinement of unneutralized plasma, (3) energy storage with an intense relativistic electron beam, (4) electrostatic heating of a tokamak, (5) electron beam formation, (6) stability problems, and (7) fusion with high-density pellets. (MOW)

352 PRODUCTION AND FOCUSING OF INTENSE RELATIVISTIC ELECTRON BEAMS AND THEIR APPLICATION TO CONTROLLED FUSION. Toepfer, A. J. (Sandia Labs., Albuquerque, NM). Ann. N.Y. Acad. Sci.; 251: 609-622(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

A review is given of electron beam generator research for controlled fusion. Experiments were carried out that indicate that a single super-pinched beam can deposit its energy uniformly over the surface of a hemispherical target, and a 10^{13} Watt accelerator is being designed that will utilize two beams to irradiate a spherical target. Some experimental results are described. (MOW)

353 NEW APPROACH TO CTR: GENERAL RELATIVISTIC POWER PLANTS. Wood, L.; Weaver, T.; Nuckolls, J. (Univ. of California, Livermore). Ann. N.Y. Acad. Sci.; 251: 623-631 (8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The use of small black holes (SBH) for producing controlled fusion power is described. The detection of SBH and power production from them are discussed. Energy conversion and transmission are mentioned. (MOW)

354 FUSION BREEDER CONCEPT. Fortescue, P. (General Atomic Co., San Diego, CA). Ann. Nucl. Energy; 2: No. 1, 29-32(Jan 1975).

Some practical aspects and broader consequences of strategies that have been proposed for the association of fusion and fission processes are reviewed. It is concluded more particularly that the build-up of the technology necessary for the ultimately desired substitution of fusion for the present fission source of nuclear power could be much advanced by an interim period of the application of fusion entirely to the breeding of ^{233}U for the large number of fission reactors that will be coexisting during this period. Principal reasons for this view are the considerable technical casements of this approach, and the very large gain in effective energy release per fusion event, which offers economic advantage long before achievement of the classic definition of the fusion "break even" point. (auth)

355 TECHNOLOGICAL REQUIREMENTS FOR POWER BY FUSION. Steiner, D. (Oak Ridge National Lab., TN). Nucl. Sci. Eng.; 58: No. 2, 107-165(Oct 1975).

The major technological requirements for fusion power, as implied by current conceptual designs of fusion power plants, are elucidated and assessed. As the point of departure the four fusion reactor concepts that have been most thoroughly considered in these design studies are described; they are the mirror, the theta-pinch, the Tokamak, and the laser-pellet concepts. The required technology is discussed relative to three principal areas of concern: (a) the power balance, that is, the unique power handling requirements associated with the production of electrical power by fusion; (b) reactor design, focusing primarily on the requirements imposed by a tritium-based fuel cycle, thermal-hydraulic considerations, and magnet systems; and (c) materials considerations, including surface erosion, radiation effects, materials compatibility, and neutron-induced activation. The major conclusions of the paper are summarized in a final section where it is noted that research and development programs have been initiated to satisfy the technological requirements associated with the realization of commercial fusion power. (auth)

356 HOT PLASMAS OF SOLID-BODY DENSITY GENERATED BY ULTRASHORT LASER PULSES. Salzmann, H. Munich; Technische Univ. (1971). 45p. (In German). INIS.

Thesis.

The focussed, pulsed radiation of a phase-coupled neodym glass laser produced energy densities of $10^3 < \epsilon < 3 \times 10^4$ I × cm^{-2}. Under these conditions, a heat wave carried by the electrons can flow into undisturbed solid material if the change of absolute light intensity on the target surface takes place faster than with 10^{31} erg cm^{-2}sec^{-2}. It could be shown experimentally that during a period of time which is longer than the duration of heating, a hot plasma of solid-body density exists. The measurements were carried out on targets of solid deuterium, carbon (spectral carbon) and hostafane ($C_{19}H_9O_4$). (GE)

Wave Phenomena

Refer also to abstract 281.

357 (AD/A-003458) ACCURATE ECONOMICAL NUMERICAL RADIATION TRANSPORT ALGORITHM. Colombant, D. G.; Winsor, N. K. (Naval Research Lab., Washington, D. C. (USA)). Dec 1974. 20p. (NRL-MR-2946). NTIS $3.25.

A multidirection radiation transport algorithm is described and tested. It numerically constructs solutions of the steady-state radiation transport equation which propagate radiation in straight lines through optically thin regions, and accurately model

the absorption of radiation in regions where the opacity may become very large. Tests are performed for external and internal sources in homogeneous or inhomogeneous media. The results are compared with analytical results and with the Milne and Schwarzschild approximations. The algorithm is shown to be superior to both approximations, in many cases, for both thin and thick cases. (GRA)

358 (AD/A-004450) COLLECTIVE INTERACTIONS IN RAPID THETA-PINCH. Khalafavi, T. A. E.; Suprunenko, V. A. Translated by F. C. Vaughn from Fiz. Plazmy Probl. Upr. Termoyad. Sin.; No. 1, 137-150(1971). 25p. (FTD-MT-24-2196-74). NTIS $3.25.

In this work the microwave radiation from the plasma of the rapid thetatron of the electronic cyclotron harmonics series lying lower than the plasma frequency was observed. The intensity of this radiation increased approximately 100 times when the frequency of the higher harmonic of this series coincided with the upper hybrid frequency. The harmonics with numbers 2, 4, and 8 were most easily excited, but radiation was not observed at fundamental frequency. The intensity of the microwave radiation from the plasma was approximately five orders higher than the thermal level. It was shown that this radiation is caused by plasma oscillations which appear in the central discharge region where conditions of continuous acceleration of electrons by a vortex electric field are satisfied. (GRA)

359 (AD/A-004469) ELECTROMAGNETIC WAVE SCATTERING FROM A TURBULENT PLASMA. Martens, C. P.; Jen, N. C. (City Coll., New York (USA)). Oct 1974. 35p. NTIS $3.75.

The Doppler spectrum of electromagnetic radiation scattered by a turbulent plasma is calculated for the case when the incident wave is a high frequency microwave or a laser beam and is not of sufficient intensity to heat the plasma. The differential scattering cross section is expressed in terms of the power spectrum of the current density fluctuations, and the wave equation and the equations of continuity and momentum for the electrons are analysed by means of the repeated cascade theory of turbulence. The equation governing the current density spectrum in the universal equilibrium range consists of three terms: a term representing the excitation of the spectrum near the wavenumber of the incident wave, a term which transfers energy across the spectrum at a rate controlled by an eddy viscosity and a molecular dissipation term. Solutions for the spectrum are obtained in the inertial and dissipation subranges. (GRA)

360 (IPP-2/228) RESONANCE CONES OF ELECTRON PLASMA WAVES IN TOROIDAL, INHOMOGENEOUS PLASMAS. Weynants, R. R.; Javel, P.; Mueller, G.; Weber, U. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1975. 8p. INIS.

The resonance cones of electron plasma waves, their trajectory and the related wave dispersion are observed and confirmed under the combined influence of toroidicity, strong inhomogeneity and energy depletion by ionization and heating up to close to the lower hybrid density. The fine structure within the cone typical for finite length exciters is also verified. (auth)

361 STRONG PLASMA SHOCK STRUCTURES BASED ON THE NAVIER-STOKES EQUATIONS. Abe, K. (Department of Applied Science, Faculty of Engineering, Kyushu University, Hakozaki, Higashi-ku, Fukuoka-shi, Japan). Phys. Fluids 18: No. 9, 1125-1130 (Sept 1975).

The structure of a plasma collisional shock wave is examined on the basis of the Navier–Stokes equations and simultaneously on the basis of the Fokker–Planck equation. The resultant structures are compared to check the validity of the Navier–Stokes equations applied to the structures of strong shock waves. The Navier–Stokes equations give quite correct structures for weak shock waves. For the strong shock waves, the detailed structures obtained from the Navier–Stokes equations differ from the results of the Fokker–Planck equation, but the shock thicknesses of the two shock waves are in relatively close agreement. (auth)

362 SELF-DUCTING OF LARGE-AMPLITUDE WHISTLER WAVES. Stenzel, R.L. (TRW Systems, Redondo Beach, California 90278). Phys. Rev. Lett. 35: No. 9, 574-577 (1 Sept 1975).

Whistler waves are launched from an electric dipole of length L in a large-volume laboratory plasma. With increasing wave amplitude the radiation pattern narrows and finally forms a duct of diameter $d \simeq L \simeq \lambda_{\parallel}$. The ducted waves propagate nearly undamped. The observed nonlinear effects are explained by wave-particle interactions. (auth)

363 COLD PLASMA WAVEBREAKING: PRODUCTION OF ENERGETIC ELECTRONS. Albritton, J.; Koch, P. (Laboratory for Laser Energetics, College of Engineering and Applied Sciences, University of Rochester, Rochester, New York 14627). Phys. Fluids 18: No. 9, 1136-1139 (Sept 1975).

Nonlinear electron plasma oscillations are investigated in the wavebreaking regime where collective energy is converted into random energy. The Lagrangian description of the electrons is extended beyond fluid element orbit crossing, thereby exposing the essential physics of wavebreaking and permitting simple analytical interpretation of it. In driven cold inhomogeneous plasma a region of large resonant oscillations decays by producing energetic electrons which escape into the less dense plasma. The maximum energy of the fast electrons produced during the driver period in which the first wave breaks is much larger than the energy of an electron oscillating freely in the driver field. The total energy of the fast electrons exceeds that supplied the system by the driver in a period and can be a significant fraction of the total energy in the oscillations at the onset of wavebreaking. (auth)

364 SYNCHROTRON RADIATION SPECTRUM FOR A RELATIVISTIC PLASMA COLUMN. Davidson, R.C. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Fluids 18: No. 9, 1143-1150 (Sept 1975).

The synchrotron radiation spectrum is calculated for a relativistic nonneutral plasma column that rotates about an axis of symmetry aligned parallel to a uniform applied magnetic field $B_0\hat{e}$. The applied magnetic field provides radial confinement of the electrons, and the electron density is assumed sufficiently low so that equilibrium self-fields have a negligible effect on the particle trajectories ($\omega_p^2/\omega_c^2 \ll 1$, where ω_p is the electron plasma frequency and ω_c is the electron cyclotron frequency). The analysis is carried out for the general class of radially confined equilibria described by equilibrium distribution functions of the form $f_e^0(x,p) = F(H)\, G(P_\theta)\, \delta(p_z)$, where H is the energy, P_θ is the canonical angular momentum, and p_z is the axial momentum. The detailed form of the emission spectrum $I_i(\omega)$ exhibits a sensitive dependence on the choice of distribution functions $F(H)$ and $G(P_\theta)$. The characteristics of the emission spectra for hollow electron layers are quite different from the emission spectra obtained when the electron density is peaked on axis. Since the influence of equilibrium self-fields on the particle trajectories is neglected in the present analysis, the results can also be applied to the synchrotron emission from rotating neutral plasma columns in which there is over-all charge neutrality. (auth)

365 TWO-DIMENSIONAL RELATIVISTIC SIMULATIONS OF RESONANCE ABSORPTION. Estabrook, K.G.; Valeo, E.J.; Kruer, W.L. (University of California, Lawrence Livermore Laboratory, Livermore, California 94550). Phys. Fluids 18: No. 9, 1151-1159 (Sept 1975).

Resonant absorption has been simulated for radiation of energy density $E^2_0/4\pi nT$ ranging from much less than to somewhat greater than unity. Characteristic features of the absorption process are an absorption efficiency of approximately 50%, generation of suprathermal particles, and strong modification of the density profile in the vicinity of the critical density. The latter effect, the appearance of a finite density variation over the distance of a few Debye lengths, is forced by strong gradients in the plasma wave intensity and electron temperature. Such a density discontinuity greatly enhances the range of incidence angles for which resonance absorption is effective and decreases the effects of the oscillating two-stream and ion-acoustic decay instabilities. (auth)

366 TWO WAVES ON A BEAM-PLASMA SYSTEM. DeNeef, P. (Department of Applied Science, University of California, Davis, California 95616). Phys. Fluids 18: No. 9, 1209-1212 (Sept 1975).

The nonlinear behavior of two unstable waves that grow simultaneously at closely spaced frequencies on a low density, initially monoenergetic beam-plasma system is calculated. The exponential spatial growth of both waves stops in the region where the beam is trapped by the waves. When the initial amplitude ratio $|\epsilon|$ (≤ 1) of the two waves exceeds 0.4, both waves play a significant role in the trapping, so the larger wave saturates at a lower potential than when launched alone. The behavior of an intermodulation product is calculated as a contribution to the spectral broadening, and the total energy in this wave plus the two launched waves is shown to evolve spatially in approximately the same way as the energy of a single frequency wave that is launched alone. (auth)

367 SURFACE WAVES AT THE INTERFACE SEPARATING TWO SLIPPING PLASMA STREAMS. Seshadri, S.R. (Department of Electrical and Computer Engineering, The University of Wisconsin, Madison, Wisconsin 53706). Phys. Fluids 18: No. 9, 1215-1216 (Sept 1975).

The characteristics of the electromagnetic surface waves supported by the interface separating two plasma streams slipping along the interface in opposite directions with the same speed are analyzed. (auth)

368 SPATIALLY GROWING WAVES IN AN ION BEAM-PLASMA SYSTEM. Fujita, T.; Ohnuma, T.; Adachi, S. (Department of Electrical Engineering, Tohoku University, Sendai, Japan). Phys. Fluids 18: No. 9, 1216-1218 (Sept 1975).

An externally excited ion wave in an ion beam-plasma system was found to grow spatially in the case where the ion beam velocity is nearly equal to an ion acoustic velocity. The phase velocity and growth

rate are in good agreement with the results based on the kinetic dispersion equation. (auth)

369 ENERGY OF PLASMA WAVES. Schmidt, G. (Stevens Institute of Technology, Hoboken, New Jersey 07030). Phys. Fluids 18: No. 9, 1218-1219 (Sept 1975).

A new definition of the sign of wave energy is given, which is valid where the old definition based on an expansion procedure breaks down. It is shown that a beam-plasma wave does not produce explosive instabilities. (auth)

370 WARM-PLASMA EFFECTS ON FAST-ALFVÉN-WAVE CAVITY RESONANCES. Swanson, D.G.; Ngan, Y.C. (Department of Electrical Engineering, University of Southern California, Los Angeles, California 90007). Phys. Rev. Lett. 35: No. 8, 517-520 (25 Aug 1975).

Whereas experiments on the ST Tokamak demonstrated fast-Alfvén-wave cavity resonances to be sharp and resolvable and suggested highly efficient coupling could be obtained for plasma heating, warm-plasma effects appropriate to fusion plasmas suggest such resonances will not be resolvable and that the characteristic mode structure will be significantly modified through the coupling to ion-Bernstein modes unless the heating is shifted to higher harmonics of the ion-cyclotron frequency. (auth)

371 MICROWAVE AMPLIFICATION WITH AN INTENSE RELATIVISTIC ELECTRON BEAM. Granatstein, V.L.; Sprangle, P.; Herndon, M.; Parker, R.K.; Schlesinger, S.P. (Naval Research Laboratory, Washington, D. C. 20375). J. Appl. Phys. 46: No. 9, 3800-3805 (Sept 1975).

A linear microwave amplifier has been constructed using an intense relativistic electron beam (5 kA, 1.2 MV) as the active medium. Stable amplification of an externally applied 100-kW signal at ~ 3-cm wavelength has been demonstrated with a spatial growth rate of 1 dB/cm and an over-all gain in this single-stage device of 16 dB. The amplifier appears to be a very wide band device having a bandwidth extending over several gigahertz. The measured characteristics of the amplifier have been compared with theoretical predictions for the relativistic electron cyclotron instability. Measurements of both the variation of amplifier gain with magnetic field strength and the linear spatial growth rate are in reasonable agreement with theoretical predictions. (auth)

372 EFFECTS OF COLLISIONS AND THERMAL PRESSURE ON THE NONLINEAR EXCITATION OF THE UPPER HYBRID RESONANCE. Chan, V.S.; Seshadri, S.R. (Department of Electrical and Computer Engineering, The University of Wisconsin, Madison, Wisconsin 53706). J. Appl. Phys. 46: No. 9, 3844-3854 (Sept 1975).

The nonlinear interaction of two ordinary modes (the pump wave and the idler or the scattered wave) and an extraordinary mode (the upper hybrid wave) propagating across the magnetostatic field in a uniform warm electron plasma is investigated. Using the parametric approximation, the threshold value of the pump wave electric field necessary for the excitation of the parametric instability near the upper hybrid resonance and the maximum growth rate of the instability are analyzed with respect to their dependence on the strength of the magnetostatic field and the relative directions of propagation. The choice of the physical parameters which will lead to the optimization of the energy transfer to the upper hybrid wave is examined. Omitting the damping of the waves, the time evolution of the amplitudes and the relative phase of the three interacting waves is determined. These amplitudes were found to vary periodically with the nonlinear period increasing with the increase in the strength of the magnetostatic field and the decrease in the amplitudes of the idler wave and the upper hybrid wave relative to that of the pump wave. The effect of the damping of the upper hybrid wave on the time evolution of the amplitudes of the three interacting waves is investigated. The amplitudes of the pump wave and the upper hybrid wave decrease to zero and that of the scattered wave increases to a saturation value either in an oscillatory or nonoscillatory manner according to whether the damping rate is below or above a critical value. The saturation amplitude of the scattered wave is found to decrease and that the coupling to the upper hybrid wave is found to increase if the extraordinary mode is excited slightly below the exact upper hybrid resonance. (auth)

373 CORRELATION STUDY OF PLASMA FLUCTUATIONS IN A HELIOTRON MAGNETIC FIELD. Zalkind, V.M.; Zykov, V.G.; Ivashchenko, A.V.; Il'enko, B.P.; Tarasenko, V.P. (Khar'kov Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov). Sov. Phys.—Tech. Phys. 20: No. 1, 101-102 (July 1975).

The fluctuations in the electric field and density of the plasma in an open heliotron magnetic trap with a magnetic potential well, $U=-\int dl/B$, are examined experimentally. Measurements of the cross correlation between the fluctuations in the plasma density and in the electric field perpendicular to the magnetic field indicate that the instability is magnetohydrodynamic. Drift of particles out of the trap is not due to turbulent diffusion since the lifetime calculated on the basis of the turbulent diffusion coefficient is much larger than the experimentally measured value. (auth)

374 COUPLED HIGH-FREQUENCY AND LOW-FREQUENCY PLASMA OSCILLATIONS. Shcheglov, O.S.; Zvereva, F.G.; Tezikov, V.V. (A. I. Mikoyan Kuibyshev Engineering Design Institute). Sov. Phys.—Tech. Phys. 20: No. 1, 105-106 (July 1975).

Coupling is studied between various high-frequency and low-frequency oscillations excited in a nonequilibrium, weakly-ionized plasma by a beam of primary electrons accelerated by the cathode drop. The experiments are carried out in a mercury-vapor discharge at 0.1—1 mtorr with various interelectrode gaps. It is shown that the nature of the coupling depends on the high-frequency oscillation. (auth)

375 PARAMETRIC EXCITATION OF PLASMA WAVES IN A RELATIVISTIC ELECTRON PLASMA. Tsikarishvili, É.G.; Tsintsadze, N.L. (Abastuman Astrophysics Observatory, Academy of Sciences of the Georgian SSR). Sov. Phys.—Tech. Phys. 20: No. 1, 107-108 (July 1975).

The parametric excitation of plasma oscillations in a relativistic plasma caused by oscillations in the electron mass in an external varying electric field is considered. The growth rates are obtained for plasma oscillations with $T_e > m_0c^2$. (auth)

376 TRANSFORMATION OF A MAGNETOACOUSTIC SOLITON IN A TWO-LAYER PLASMA. Pelinovskii, E.N.; Stepanyants, Yu.A. (Radiophysics Scientific-Research Institute, Gor'kii). Sov. Phys.—Tech. Phys. 20: No. 1, 109-110 (July 1975).

The propagation of a small-amplitude magnetoacoustic soliton is investigated in a cold plasma with a density discontinuity. For any value of the density difference, at most two solitons are formed in the transmitted wave. Calculations of the secondary soliton amplitudes by inverse scattering problem and from conservation relations are compared. (auth)

377 THEORY OF IONIZATION WAVES. Alanakyan, Yu.R.; Mikhalev, L.A. Sov. Phys.—Tech. Phys. 20: No. 1, 5-9 (July 1975).

The electron distribution function in the positive column of a gas discharge is found in the presence of periodic perturbations of the plasma parameters. The transport equation is solved with allowance for electron-electron collisions, elastic and inelastic electron-atom collisions, and interaction between the electrons and an electric field. A study is made of the ionization wave due to high-energy plasma electrons that participate in impact ionization processes and the main bulk of the electrons, whose distribution function is nearly Maxwellian. The dispersion relation and stability condition are obtained. (auth)

378 EXCITATION OF MAGNETOSONIC PULSES IN MANDEL'SHTAM-BRILLOUIN SCATTERING IN A PLASMA. Petrukhin, N.S.; Fainshtein, S.M. (A. A. Zhdanov Gor'kii Polytechnic Institute). Sov. Phys.—Tech. Phys. 20: No. 1, 92-93 (July 1975).

The interaction of two high-frequency (hf) electromagnetic waves with magnetosonic waves is considered in a magnetoactive plasma. It is assumed that the waves propagate in the direction perpendicular to the magnetic field. The efficiency of the generation of magnetosonic pulses is demonstrated. Equations are derived for the amplitudes of the interacting waves. Estimates are given for laboratory plasma conditions. (auth)

379 EXCITATION OF ION-ACOUSTIC WAVES BY RF WAVES AT THE BOUNDARY OF A PLASMA. Benkhabib, F.; Kondratenko, A.N. (A. M. Gor'kii Khar'kov State University). Sov. Phys.—Tech. Phys. 20: No. 1, 16-18 (July 1975).

The amplitudes of ion-acoustic waves excited in a plasma by rf surface waves or by rf waves impinging on the plasma and penetrating to the skin depth are calculated in the weakly nonlinear approximation. The amplitude of the ion-acoustic wave[19] is particularly large when it is excited by waves incident at different angles or by an incident wave and a surface wave. (auth)

380 GAS CONDITIONS AFTER THE PASSAGE OF REFLECTED SHOCK WAVES AND THEIR APPLICATION TO TORUS-LIKE EXPERIMENTS. Kasuya, K.; Kagaya, Y.; Murasaki, T. (Department of Mechanical Engineering, Faculty of Engineering Science, Osaka University, Toyonaka, Osaka, Japan). Rev. Sci. Instrum. 46: No. 10, 1394-1395 (Oct 1975).

In this article we describe briefly recent results on basic processes concerning a crowbar method utilizing reflected shock waves by a pressure-driven shock tube. After that, we propose an apparatus which is an application of this crowbar technique to a new method for producing plasmas. (auth)

381 MODE CONVERSION OF TOROIDAL ALFVÉN WAVES. Swanson, D.G. (Department of Electrical Engineering, University of Southern California, Los Angeles, California 90007). Phys. Fluids 18: No. 10, 1269-1276 (Oct 1975).

The effects of electron inertia and mode conversion on the propagation of Alfvén waves in toroidal magnetic fields are considered. When electron inertia is neglected, two singularities occur in the equation determining the radial and vertical wavefield dependencies. The inclusion of electron inertia resolves one singularity and is shown to lead to linear mode conversion in either a cold electron or warm

electron approximation. The Alfvén wave converts to an electrostatic wave which propagates back toward the inside of the torus in the cold electron approximation and through the ion cyclotron resonance toward the outside edge of the torus with warm electrons via the electrostatic ion cyclotron wave. Without damping, both lead to a discrete spectrum of eigenfrequencies, but with only weak damping, the electrostatic waves are absorbed and lead to a continuous spectrum of frequencies. The nature of the damping terms gives an indication of the type of energy absorption, whether Landau damping of electrons or ions or ion cyclotron damping. The second singularity in the equations is found to have only regular solutions and does not lead to mode conversion. (auth)

382 FREQUENCY AND DAMPING OF ION ACOUSTIC WAVES. Ono, M.; Kulsrud, R.M. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Fluids 18: No. 10, 1287-1293 (Oct 1975).

The frequency and damping of ion-acoustic waves in a singly ionized plasma have been determined for wavelengths at which collisions are important but not dominant and for electron-ion temperature ratios of 0.5, 1, 2, and 4, by numerically solving the linearized Fokker–Planck equation. The collisional and collisionless limits are in good agreement with existing theory. As a by-product the ion viscosity and thermal conductivity were evaluated and agreed with those of Braginskii. (auth)

383 MODULATIONAL STABILITY OF THE ION PLASMA MODE. Chan, V.S.; Seshadri, S.R. (Department of Electrical and Computer Engineering, The University of Wisconsin, Madison, Wisconsin 53706). Phys. Fluids 18: No. 10, 1294-1298 (Oct 1975).

The cubic Schrödinger equation satisfied by the slowly varying amplitude of the longitudinal wave in an electron-ion plasma is deduced using the method of Kakutani and Sugimoto. The analysis of the Schrödinger equation shows that the ion acoustic wave is modulationally stable and that the ion plasma oscillations are modulationally stable or unstable according to whether the wavenumber is below or above a critical value which is controlled entirely by the wave dispersion. (auth)

384 COMPUTATIONAL STUDY OF NONLINEAR PLASMA WAVES: I. SIMULATION MODEL AND MONOCHROMATIC WAVE PROPAGATION. Matsuda, Y.; Crawford, F.W. (Institute for Plasma Research, Stanford University, Stanford, California 94305). Phys. Fluids 18: No. 10, 1336-1345 (Oct 1975).

An economical low-noise plasma simulation model originated by Denavit is applied to a series of problems associated with electrostatic wave propagation in a one-dimensional, collisionless, Maxwellian plasma, in the absence of magnetic field. The model is described and tested, first in the absence of an applied signal, and then with a small amplitude perturbation. These tests serve to establish the low-noise features of the model, and to verify the theoretical linear dispersion relation at wave energy levels as low as 10^{-6} of the plasma thermal energy: Better quantitative results are obtained, for comparable computing time, than can be obtained by conventional particle simulation models, or direct solution of the Vlasov equation. The method is then used to study propagation of an essentially monochromatic plane wave. Results on amplitude oscillation and nonlinear frequency shift are compared with available theories. (auth)

385 COMPUTATIONAL STUDY OF NONLINEAR PLASMA WAVES: II. SIDEBAND INSTABILITY AND SATELLITE GROWTH. Matsuda, Y.; Crawford, F.W. (Institute for Plasma Research, Stanford University, Stanford, California 94305). Phys. Fluids 18: No. 10, 1346-1353 (Oct 1975).

The low-noise plasma simulation model is applied to study two phenomena associated with large amplitude wave propagation and the resulting particle trapping: sideband instability and satellite wave growth. Simulations are carried out to observe amplification of test waves and growth from noise. They are performed in parameter ranges for which detailed quantitative comparison with available theories is possible, and which are readily accessible experimentally. The study of sideband instability confirms the applicability of quasi-linear theory at short times, and parametric coupling theory in the time-asymptotic limit, and reproduces features analogous to those observed in laboratory experiments. The growth of a satellite wave in the presence of a large amplitude wave and a test wave is shown to be explicable by a simple theory involving slow modulation of the large amplitude wave. (auth)

386 THREE WAVE BACKSCATTER INTERACTIONS IN A FINITE REGION. Harvey, R.W.; Schmidt, G. (Stevens Institute of Technology, Hoboken, New Jersey 07030). Phys. Fluids 18: No. 10, 1395-1396 (Oct 1975).

The space-time, three wave, coupled mode equations are numerically integrated for a backscatter process in a finite region, with zero-reflection boundary conditions. It is found that only spatially aperiodic steady states are stable. Effects of damping on the scattered waves are investigated. (auth)

387 INTERPRETATION OF SOLITON FORMATION AND PARAMETRIC INSTABILITIES. Manheimer, W.M.; Papadopoulos, K. (Naval Research Laboratory, Washington, D.C. 20375). Phys. Fluids 18: No. 10, 1397-1398 (Oct 1975).

It is shown that soliton formation and the resulting plasma heating are nothing more than the description in configuration space of well-known parametric processes and quasi-linear theory. (auth)

388 REFLECTION AND TRANSMISSION THEOREMS FOR CHARACTERISTIC WAVES IN STRATIFIED ANISOTROPIC ABSORBING MEDIA. Suchy, K. (Duesseldorf Univ.); Altman, C. J. Plasma Phys.; 13: 437-449(Jun 1975).

The solutions of Maxwell's equations and of their adjoint equations, being essentially different in absorbing media, are written in terms of matrizants. A relation between these is established, utilizing the constancy of the bilinear concomitant. With this, and with the concept of the conjugate field, introduced in Suchy & Altmann (Suchy, K. & Altman, C., 1975, J. Plasma Phys., 13, 299), a theorem, connecting the transfer matrices of the field and the conjugate field, is derived. This, in turn, leads to a corresponding theorem connecting the scattering matrices, which are composed of the reflection and transmission matrices. (auth)

389 SELF-MODULATION AND STABILITY OF FINITE-AMPLITUDE ORDINARY AND EXTRAORDINARY WAVES IN A COLD MAGNETOPLASMA. Furutani, Y. (Univ., Paris). J. Plasma Phys.; 13: 499-522(Jun 1975).

The self-modulation parameter of the ordinary and the extraordinary waves propagating in a cold magnetoplasma is given explicitly, by the familiar reductive perturbation method, in the framework of the hydrodynamic approach. Both quantitative and qualitative order-of-magnitude analysis of this parameter are carried out for the lower-hybrid and the upper-hybrid branches of the extraordinary wave. The usefulness of the stability criterion, which is linear with respect to an envelope of these linear waves, is also discussed. (auth)

390 PROPAGATION OF A PULSE IN A DISPERSIVE PLASMA: AN EXACT SOLUTION COMPARED WITH VARIOUS APPROXIMATIONS. Buckley, R. (Imperial Coll. of Science and Tech., London). J. Plasma Phys.; 13: 539-552(Jun 1975).

This paper considers an example of the propagation of a finite wave-train in a plasma of relatively simple dispersive properties. In this case, the wave field can be evaluated exactly. The concept of a wave-packet moving at the group speed can therefore be tested rigorously. Various approximations to the field, physically more transparent than the exact solution, are presented and compared with the latter. One of these, relevant in the neighbourhood of the ideal group front, is in fact applicable to a wide range of dispersion laws. The paper demonstrates broadening with time, and eventual disappearance of, the pulse. (auth)

391 HIGH FREQUENCY ELECTROMAGNETIC DRIFT WAVES. Detyna, E.; Wooding, E. R. (Royal Holloway Coll., London). Plasma Phys.; 17: No. 7-8, 539-546(Jul 1975).

A general dispersion relation has been derived for high frequency electromagnetic drift waves in the range $\omega_{ci} \ll \omega \ll \omega_{ce}$ arising from an electron stream drifting in a density gradient in a plasma which is penetrated by external electric and magnetic fields. Criteria for stability are obtained. The theory is valid for all values of the ratio of electron drift to ion thermal velocities. (auth)

392 NONLINEAR THEORY OF EXCITATION OF A MONOCHROMATIC ELECTRON CYCLOTRON WAVE IN PLASMA. Lominadze, J. G. (Inst. of Physics, Tbilisi, USSR). Ann. N. Y. Acad. Sci.; 251: 312-321(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Using a partial numerical simulation, the nonlinear stage of electron cyclotron instability was considered in a single-mode regime. It is shown that the trapping of resonance ions may lead to the stabilization of the kinetic instability. The maximum amplitude of the field is determined for such a mechanism of stabilization, and the condition of the latter applicability is found. (MOW)

393 MICROWAVE PRODUCTION WITH INTENSE RELATIVISTIC ELECTRON BEAMS. Hammer, D. A.; Friedman, M.; Granatstein, V. L.; Herndon, M.; Manheimer, W. M.; Parker, R. K.; Sprangle, P. (Naval Research Lab., Washington, DC). Ann. N.Y. Acad. Sci; 251: 441-457(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Some experiments in which static magnetic compression was used to produce high microwave power are described. It is shown how the microwave power and frequency spectrum depend upon the beam transverse energy, total electron energy, and magnetic field. Experimental results obtained using the rippled magnetic

field are presented for comparison. This is followed by a theoretical model, with both linear and nonlinear results being presented. A detailed comparison between theoretical and experimental results is given. (MOW)

394 GEOMETRICAL RESONANCES OF A PLASMA NEAR THE LOWER HYBRID FREQUENCY. Kraemer, M. Bochum, Ger.; Bochum Univ. (1974). 67p. (In German). INIS.

Thesis.

It is shown that geometrical resonances of an inductively excited cylindrical plasma in the region of the lower hybrid resonance are due to the electric ring fields. In observing characteristic properties of resonance, discrepancies obtained between theory and experiment are: (a) resonance peaks in small magnetic fields and (b) the absolute value of the absorption peak. The discrepancies are explained by means of a few assumptions. (GE)

395 NONLINEAR WAVENUMBER OF AN ELECTRON PLASMA WAVE. Vidman, P. J. San Diego; Univ. of California (1975). 153p. University Microfilms Order No. 75-11,287.

Thesis (Ph. D.).

The wavenumber of a large amplitude electron plasma wave propagating on a collisionless plasma column is measured. The wavenumber is not the same as the wavenumber of a small amplitude wave at the same frequency. The space dependence, magnitude, and scaling with amplitude and frequency of the nonlinear wavenumber shift are determined. The linear and nonlinear theories are reviewed and transformed to the cylindrical geometry of the experiment. According to the theory, the nonlinear wavenumber shift, delta k/sub r/, is small near the transmitter, increases at larger distances and oscillates in space about some asymptotic value. The oscillation length of delta k/sub r/ is half that of the nonlinear amplitude oscillations. The positions of the maxima of delta k/sub r/ are proportional to (PHI)$^{1/2}$ where PHI is the initial wave amplitude. The magnitude of delta k/sub r/ is proportional to root PHI k/sub i/ where k/sub i/ is the linear damping coefficient. The experimental apparatus and the measurement techniques are described. (Diss. Abstr. Int., B)

ENGINEERING

396 (N-75-22373) FRONTIERS IN PROPULSION RESEARCH: LASER, MATTER–ANTIMATTER, EXCITED HELIUM, ENERGY EXCHANGE THERMONUCLEAR FUSION. Papailiou, D. D. (ed.). (Jet Propulsion Lab., Pasadena, Calif. (USA)). 15 Mar 1975. 213p. (NASA-CR-142707; JPL-TM-33-722). NTIS $7.25.

Energy Conversion

Refer also to abstracts 824 and 1182.

397 (N-73-13703) CLOSED CYCLE MHD SPECIALIST MEETING. Progress Report, 1971-1972. Rietjens, L. H. (Technische Hogeschool Eindhoven (Netherlands)). Apr 1972. 36p. (TH-72-E-29). NTIS $4.00.

From MHD specialist meeting; Eindhoven, Netherlands (20 Sep 1975).

Abstracts of the conference papers on closed cycle MHD research are presented. The general areas of discussion are the following: results on closed cycle experiments; plasma properties, and instabilities and stabilization in nonequilibrium plasmas; loss mechanisms, current distributions, electrode effects, boundary layers, and gas dynamic effects; and design concepts of large MHD generators, and nuclear MHD power plants. (GRA)

398 SOVIET MHD: A DYNAMIC PROGRAMME. White, S. New Sci.; 67: No. 956, 22-24(3 Jul 1975).

The backbone of the Soviet Union MHD research programme is the open cycle generator where the hot plasma is used to raise steam in a conventional power plant after it has done its work of creating electricity by cutting across the magnetic field of the MHD generator. Both the 100 kW U-02, built in 1965, and its successor, the U-25, are open cycle MHD generators. The layout of the U-25, which has already generated a stable 6 MW with continuous runs of more than 6 hours, is shown. The MHD generator is the key element of the whole plant, and the most complex as far as power engineering goes. The combustion chamber of the U-25 is also an area of tremendous research and development. The technical and engineering problems posed by the new generator are discussed. There are plans to develop an industrial plant with a 1000 MW open cycle MHD generator by 1981. The Soviet Union has also been doing work on closed cycle generators where a plasma also acts as the working body but is recycled continuously through the generator. The possible advantages of this method are considered. (UK)

Facilities and Equipment

Refer also to abstracts 1181, 2333, and 2547.

399 (CONF-751106-4) HEAT EXCHANGERS FOR HIGH-TEMPERATURE THERMODYNAMIC CYCLES. Fraas, A. P. (Oak Ridge National Lab., Tenn. (USA)). 1975. 34p. Dep. NTIS $5.00.

From annual meeting of ASME; Houston, Texas, USA (30 Nov 1975).

The special requirements of heat exchangers for high temperature thermodynamic cycles are outlined and discussed with particular emphasis on cost and thermal stress problems. Typical approaches that have been taken to a comprehensive solution intended to meet all of the many boundary conditions are then considered by examining seven typical designs including liquid-to-liquid heat exchangers for nuclear plants, a heater for a closed cycle gas turbine coupled to a fluidized bed coal combustion chamber, steam generators for nuclear plants, a fossil fuel-fired potassium boiler, and a potassium condenser-steam generator. (auth)

400 (LA-6053-PR) USERDA DIVISION OF ELECTRIC ENERGY SYSTEMS DC SUPERCONDUCTING POWER TRANSMISSION LINE PROJECT AT LASL, JANUARY 1–MARCH 31, 1975. Keller, W. E.; Taylor, R. D. (comps.). (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1975. 23p. Dep. NTIS $4.00.

The ninth progress report of the Los Alamos Scientific Laboratory dc Superconducting Power Transmission Line (SPTL) Development Project covers the period January 1 to March 31, 1975. The measured magnetic field profile near a superconducting tape carrying a current is explained by a simple model of the current distribution. The propagation velocity of a normal zone in a stabilized superconductor was measured and found to depend on the direction of the current flow. Some efficiency and cost factors of several possible designs for a dc SPTL are compared with transmission line alternatives. (auth)

401 (ORNL-SUB-3193-1) STRESS OF TEE JOINTS BY THE FINITE ELEMENT METHOD. Gantayat, A. N.; Powell, G.H. (California Univ., Berkeley (USA). Structural Engineering Lab.). Feb 1973. 248p. Dep. NTIS $9.00.

For Oak Ridge National Lab., TN.

A series of three computer programs for the stress and thermal stress analysis of tee joints to ASA B16.9 is described. Detailed user's guides to the programs are presented, and the results of analyses are compared with experimental measurements obtained elsewhere. An investigation to select the most appropriate finite element for inclusion in the programs is described. The finite element theory, for both stress and transient heat flow analysis, is presented in detail. Listings of input data for sample problems are included. It is concluded that results in good agreement with experiment can be obtained, but that further studies of the effects of mesh refinement remain to be carried out. (auth)

402 (ORNL-tr-4023) CHARACTERISTICS AND APPLICATIONS OF VACUUM SWITCHGEARS. Matsuda, A.; Takada, A.; Hirai, K.; Ota, A.;. Translated by H. Kubota From Nat. Tech. Rep. (Matsushita Elec. Ind. Co., Osaka); 18: No. 5, 526-548(1972). 52p. Dep. NTIS $5.75.

The vacuum switchgears are suitable for high voltage switching devices since vacuum is extraordinarily efficient as a switching medium and the interrupting arc is completely enveloped. Vacuum switches were developed with ceramic valves and, these days, they are used for most of the commonly encountered duties of distribution lines or load control equipment. The advantages of vacuum switchgears are these (1) space saving, (2) safety improvement, and (3) reduced maintenance. Utilization of vacuum switches has ideally improved the reliability of switching devices for distribution lines and load control devices. This paper discusses vacuum switchgears in this field, with the proper application of vacuum switches. (auth)

403 HIGH ENERGY ELECTRON TREATMENT OF WATER. Trump, J. G. (to High Voltage Engineering Corp.). US Patent 3,901,807. 26 Aug 1975. Filed date 27 Jun 1973. 8p.

The microbiological and chemical activity of water containing microorganisms and other impurities is reduced by irradiating such water with high energy electrons. A device mixes the water with a gas to supply the water with oxygen and the water passes through a constricted region wherein the electron beam irradiates the water. The structure of the several embodiments of the constricted region results in an economical system that uniformly and sufficiently irradiates the water passing therethrough. (auth)

Lasers

Refer also to abstract 1817.

404 (AD/A-003582) RESEARCH ON MOLECULAR LASERS. Annual Report, 1 October 1973–30 September 1974. Wolga, G. J.; Bauer, S. H.; McFarlane, R. A.; Cool, T. A. (Cornell Univ., Ithaca, N. Y. (USA)). Nov 1974. Contract N00014-67-A-0077. 112p. NTIS $5.25.

See also report dated Jul 74, AD--784774.

Research concerning molecular and chemical lasers was conducted in the following areas: (1) measurement of vibrational energy transfer rates in the HF, DF, HF-DF, HF-CO_2, and DF-CO_2 systems over the temperature range 200 to 350°K; (2) experimental design and testing of experiments to measure vibration to rotation energy transfer in HF; (3) vibrational relaxation measurements at T = 300°K of HF(v = 1) DF(v = 1) and CO_2(001) by atoms including H, D, O, N, F, Cl, and Br; (4) vibrational relaxation measurements at T = 300°K of CO(v = 1) by atoms with initial work centering on oxygen atoms; and (5) chemical laser studies in the following areas: bending mode relaxation of CO_2, computer model for the CS_2-O_2-He chemical laser; alternate hydrogen sources for HF and DF lasers; laser heating initiated chemical reactions; CO v = 1−0 pulsed chemical laser; C_3O_2 + He chemical CO laser; model for the C_3O_2 + O_2 + He laser; laser initiated reactions in mixtures of B_2H_6. (GRA)

405 (AD/A-003584) CARBON MONOXIDE LASER. Annual Technical Report. Center, R. E.; Boness, M. J. W. (Avco-Everett Research Lab., Everett, Mass. (USA)). Jan 1975. Contract N00014-72-C-0030. 65p. NTIS $4.25.

See also AD-780274.

The main objective of this program is the investigation of the

pulsed electrical CO laser to determine the relative scaling parameters and the usefulness of high power CO lasers in systems applications. The current contract has included measurements of small signal gain on varying vibrational and rotational transitions, operation with an unstable resonator and the design fabrication and assembly of an entirely new transverse flow system together with a new heat exchanger. Gain measurements were compared with parametric performance predictions derived from kinetic modelling calculations. The new flow system discharge cavity and heat exchanger have been designed with the aim of obtaining a near diffraction limited beam from the pulsed CO laser. The design considerations are described. (GRA)

406 (AD/A-003621) CALCULATIONS OF THE FREQUENCY DEPENDENCE OF ELASTO-OPTIC CONSTANTS OF INFRARED LASER WINDOW MATERIALS. Physical Sciences Research Papers. Bendow, B.; Gianino, P. D. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 24 Oct 1974. 100p. (AFCRL-PSRP-608; AFCRL-TR-74-0533). NTIS $4.75.

Stress-induced birefringence may severely degrade or limit the optical performance of infrared transmitting materials, especially in high power laser applications. Thus, prediction of this phenomenon is essential for the appropriate selection of high power ir laser window materials for numerous applications. In this report a detailed first-principles calculation of the elasto-optic, or strain-optic, constants P_{ij} is carried out for the first time throughout infrared frequencies, employing a recent theory of Humphreys and Maradudin. For ionic crystals, a Born-Mayer interatomic potential is used, while for semiconductors a Morse potential is used. Two methods for obtaining the P_{ij} are applied: one incorporates parameters based on standard thermodynamic prescriptions, the other combines these same parameters with additional ones derived from pressure-dependent data. For both cases, the dispersions in the P_{ij}, as well as in the thermal lensing parameters, are calculated throughout the ir regime for a wide variety of rocksalt- and zinc blende-structure compounds. (GRA)

407 (AD/A-003626) PICOSECOND PULSES DUE TO SELF-MODE-LOCKING IN LASERS. Interim Report, January–February 1974. Taboada, J. (School of Aerospace Medicine, Brooks AFB, Tex. (USA)). Feb 1974. 26p. (SAM-TR-74-47). NTIS $3.75.

Picosecond pulses due to self-mode-locking have been observed in the Chromatix 1000 Nd-YAG and Spectra Physics 125 HeNe lasers. In the Chromatix 1000 laser, self-mode-locking appears to be a random event; whereas in the Spectra Physics 125 laser, self-mode-locking appears to be continuous. The results of an experimental study of these two lasers are presented in the context of their operation and a simplified theory of mode locking in lasers. The implications of this study to ocular-tissue laser-damage threshold measurements and safety are discussed. (GRA)

408 (AD/A-003666) LASER WINDOW SURFACE FINISHING AND COATING TECHNOLOGY. Semiannual Technical Report No. 2. Braunstein, M. (Hughes Research Labs., Malibu, Calif. (USA)). Aug 1974. Contract F19628-73-C-0243. 55p. NTIS $3.75.

See also semiannual technical rept. No. 1, AD-777888.

Potassium chloride surfaces have been produced on reactive atmosphere processed (RAP) KCl using HCl etching which show an order of magnitude improvement in KCl surface damage resistance. Surface damage level approaches the bulk level in some KCl samples. An inverse dependence of 10.6 micrometer optical absorption on film deposition rate is reported for germanium films, beta of approximately 10/cm is reported for the best films. Ion beam sputtering of ThF_4 using pure argon ion beams results in films deficient in fluorine having high optical absorption at 10.6 micrometers. Reactive sputtering in argon-fluorine gas mixtures may be required for producing stoichiometric fluoride films. Rutherford backscattering for chemical analysis of films and window surface structure promises to be a new powerful technique for such studies, using moderate beam energies of 180 keV H(+) and 280 KeV H(++). (GRA)

409 (AD/A-003989) ELECTRONIC RAMAN EFFECT IN GARNETS, TUNABLE INFRARED LASERS, AND QUANTUM COUNTERS. Final Report, 1 March 1971–31 August 1974. Chang, R. K. (Yale Univ., New Haven, Conn. (USA). Dept. of Engineering and Applied Science). Oct 1974. 61p. NTIS $4.25.

The Raman technique has been applied to study some basic properties of rare-earth garnets. Preliminary investigations have been performed on a tunable ir quantum counter and Ho:YIG laser. Using Raman scattering, the following were determined: (1) the phonon energy and symmetry assignments of numerous garnets (YAlG, DyAlG, YbAlG, LuAlG, YGaG, DyGaG, YbGaG, LuGaG, YIG, DyIg, ErIG, and YbIG); (2) the energy of the lower crystal-field levels (10-4000/cm) in YbAlG, YbGaG, DyAlG, DyGaG, and ErIG; (3) the dipole and exchange-field splittings of several electronic levels for DyAlG below its Neel temperature; and (4) the accuracy of the crystal-field parameters by comparing the calculated with the observed Raman intensity. The large anisotropic exchange interaction between the Fe3+ and Re3+ ions in Re:YIG can form the basis for tunable ir quantum counters and lasers. A tunable quantum counter in the 5 micrometer region is proposed by using Pr:YIG. The author has achieved laser action by optically pumping with a Nd:glass laser into the absorption band of the host crystal (YIG). Based on this achievement, it is estimated that lasing from a 100 micrometer thick slab of Ho:YIG is possible by pumping with a single GaAs laser diode. (GRA)

410 (AD/A-004029) LASER WINDOW STUDIES. Semiannual Technical Report, 20 May–20 November 1974. Bua, D.; Statz, H.; Horrigan, F. (Raytheon Co., Waltham, Mass. (USA). Research Div.). Dec 1974. Contract DAAH01-74-C-0719. 87p. (S-1790). NTIS $4.75.

This report deals largely with the characterization of films (ZnSe, ZnS, As_2S_3 and ThF_4) on high power laser window substrates (BaF_2 and ZnSe). Thus far attenuated total internal reflection spectra have been taken of As_2S_3 on BaF_2; and calorimetric measurements for film absorption studies have been developed and applied to As_2S_3 on BaF_2. A literature search has been undertaken to determine liquid coolants for high power windows but no promising candidates were found. A literature search of the mechanical, physical and chemical properties of films was made. Adhesion measurements have begun using pull tests and peeling tests, as well as microhardness measurements using a small diamond indenter in conjunction with the scanning electron beam microscope. (GRA)

411 (AD/A-004072) MULTIPLE-SELECTED-LINE UNSTABLE RESONATOR. Chodzko, R. A. (Aerospace Corp., El Segundo, Calif. (USA)). 31 Dec 1974. Contract F04701-74-C-0075. 24p. NTIS $3.25.

A new type of unstable resonator has been developed that permits multiple-selected-line operation. Selected-line operation is obtained with a diffraction grating oriented at an angle different from the Littrow angle. Secondary feedback mirrors at the appropriate angles provide an independent three-element cavity for each wavelength selected. Two types of multiple-selected-line unstable resonators are considered: (1) an edge-coupled design, which produces an annular beam with a 45-deg output coupling mirror, and (2) a continuously coupled design, which uses the primary zero-order beam as output. Experiments have been carried out with a multiple-selected-line unstable resonator on a cw HF laser. Selected-line operation was obtained on the P2 and P1 HF transitions in a continuously coupled design. (GRA)

412 (AD/A-004138) THEORETICAL STUDY AND EXPERIMENTAL DEVELOPMENT OF THIN-FILM LASERS AND MODULATORS FOR USE IN INTEGRATED OPTICS. Final Report. Wang, S. (California Univ., Berkeley (USA). Electronics Research Lab.). Dec 1974. 7p. NTIS $3.25.

Wave-optics analysis of thin-film modulators based on the principle of polarization conversion was completed and experimental demonstration of the principle was performed. Novel structures for Bragg lasers were proposed and analyzed. The feedback mechanisms were elucidated which made possible many possible structures for thin-film Bragg lasers. Experimental work on gratings and chemical etching showed excellent results. (GRA)

413 (AD/A-004300) CaF_2 LASER WINDOW STUDY. Final Report. Holmes, S. J.; Kraatz, P.; Klugman, A. (Northrop Research and Technology Center, Hawthorne, Calif. (USA)). Nov 1974. Contract N00014-75-C-0009. 34p. (NRTC-74-57R). NTIS $3.75.

Single crystal calcium fluoride material has been polished, antireflection coated and characterized. The objective of this effort was to obtain the necessary surface preparation and antireflection coating (PbF2, ThF4, MgF2, BaF2) information for single crystal calcium fluoride substrates for use as high energy/power windows operating in the 3 to 5 micrometer wavelength region. (GRA)

414 (AD/A-004403) INVESTIGATIONS OF A GAS-DYNAMIC Co_2-LASER. Biryukov, A. S.; Dronov, A. P. 27 Nov 1974. Translated by R. D. Hill from pp 694-697 of Gorenie i Vzryv, Moscow, 1972. (FTD-MT-24-2013-74). 11p. NTIS $3.25.

415 (AD/A-004418) INVESTIGATION OF THE STABILITY OF LASER DISCHARGES. Interim Report, 22 January 1973–28 February 1974. Bullis, R. H.; Nighan, W. L.; Wiegand, W. J. (United Aircraft Research Labs., East Hartford, Conn. (USA)). Nov 1974. Contract F33615-73-C-4107. 58p. (UARL-M-921612-5). NTIS $4.25.

Experimental and analytical investigations have revealed that

negative ion processes affect both the steady discharge characteristics and the plasma stability of high power, carbon dioxide lasers. Computations including the pertinent negative ion attachment/detachment reactions have successfully modeled the measured steady properties of these volume-dominated discharges. However, the theoretical stability analysis indicates that conditions favoring ionization instability are readily achieved. Experimental detection of systematic plasma fluctuations confirms that ionization instability induced by molecule attachment reactions leads to the formation of running striations. As anticipated theoretically, these are removed by the addition to the original gas mixture of molecules such as CO and hydrogen which detach electrons from the atomic oxygen negative ion. Additional studies indicate that very small concentrations of plasma produced impurities such as NO, nitrous oxide, and nitrogen dioxide adversely affect discharge stability through their influence on negative ion processes. (GRA)

416 (AD/A-004551) DAMAGE THRESHOLD STUDIES OF GLASS LASER MATERIALS. Final Report, 1 July 1972–31 August 1974. Boling, N. L.; Dube, G. (Owens-Illinois, Inc., Toledo, Ohio (USA). Corporate Technology Div.). 31 Aug 1974. Contract DAHC15-72-C-0170. 210p. NTIS $7.25.

See also report dated 30 Jun 1973, AD-767049.

In Section I, results of studies of Q-switched laser damage to transparent uncoated dielectric surfaces are presented. It is concluded that surface scratches and digs on some conventionally polished glasses are not of prime importance in damage. Rather, contaminants left by the polishing process determine the damage threshold. Removal of these contaminants can be effected by treatment in hot nitric acid or hot water, raising the threshold to as high as 500 J/cm^2(30 ns). The effectiveness of the treatment is dependent on polishing history. An analysis of pulse cutoff by the damage site is also presented. It is concluded that the shape of the cutoff is not related to the damage mechanism, but rather to the manner in which the plasma expands across the laser beam. In Section II, results of experiments on the feasibility of a high energy density Nd: glass laser are reported. Damage-free operation at more than 4.4 GW/cm^2(70 J/cm^2 in a 15 ns pulse) was achieved. Restraints on higher irradiance operation and possible improvements are discussed. (GRA)

417 (AD/A-004629) ULTRANARROWBAND TUNABLE DYE LASER FOR NEW APPROACHES TO ATOMIC SPECTROSCOPY. Technical Report No. 3, 1 January–31 December 1974. Hansch, T. W. (Stanford Univ., Calif. (USA). Microwave Lab.). Dec 1974. Contract N00014-67-A-0012-0071. 31p. (ML-2391). NTIS $3.75.

See also AD-772556, dated 1 Jan–31 Dec 74.

The report summarizes a successful experiment to measure the Rydberg constant with an accuracy of one part in 100 million by saturation spectroscopy of the Balmer line of atomic hydrogen and deuterium, using a repetitively pulsed tunable dye laser. The second, largest part of the report gives design features and operating characteristics of a newly developed dye laser oscillator/amplifier system, pumped by 1 MW nitrogen laser, which offers one or two orders of magnitude higher peak power per spectral interval than any other presently available dye laser, using comparable pump source. Its potential for nonlinear molecular spectroscopy is illustrated by a high resolution two-photon excitation spectrum of benzene vapor. The third part reports on the generation of the narrowband tunable ultraviolet radiation by frequency doubling of the dye laser output. (GRA)

418 (AD/A-004647) RESEARCH IN MATERIALS SCIENCE. Semiannual Technical Report No. 3, 1 July–31 December 1974. Epstein, D.; Rose, R. M.; MacVicar, M.; Lagow, R. (Massachusetts Inst. of Tech., Cambridge (USA). Center for Materials Science and Engineering). 31 Dec 1974. Contract DAHC15-73-C-0316. 228p. NTIS $7.50.

See also report dated 30 Jun 74, AD–782573.

Results and status are presented of work after the third six month period of this program which consists of three separate tasks including the following: optoelectronic materials and components; minilaser development, diode pumps, KTN modulator program, coupling from laser to wave guide, feed materials for crystal growth; superconducting transition metal alloys; development of surfaces and tunneling barriers for A15 substrates; chemical synthesis using high temperature lithium vapor species; initiation of program involving the synthesis of polymers and diamond-like materials; problem of purification and separation of the novel polylithium compounds. (GRA)

419 (AD/A-004763) SOLID STATE RESEARCH, 1974:4. Quarterly Technical Summary, 1 August–31 October 1974. McWhorter, A. L. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 15 Nov 1974. Contract F19628-73-C-0002. 71p. NTIS $4.25.

See also AD/A-001595.

This report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 August through 31 October 1974. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, and Microelectronics. (GRA)

420 (AD/A-004817) POSSIBILITY OF CONSTRUCTING PULSED GAS LASERS WITH ELECTRON BEAM PUMPING IN AN ELECTRIC FIELD. Afanasev, Yu. V; Belenov, E. M. 20 Nov 1974. Translated from Vysokomolekulyarnye Soedineniya. Seriya B; Kratkie Soobshcheniya (USSR) nll Nov 70. (FTD-HC-23-2596-74). 9p. NTIS $3.25.

The paper reports the possibility of constructing pulsed gas lasers with mixed excitation when the gas is pumped with an electron beam and an electric field simultaneously. The proposed excitation method makes it possible, in principle, to obtain high radiated laser power owing to uniform excitation of large gas volumes at high pressures. The role of the electron beam actually amounts to the creation of conditions for streamerless discharge development, and the excitation energy comes mainly from the external electric field. (GRA)

421 (CONF-720360-, pp 27-42) BASIC DEVICE PROPERTIES IN THE LEAD CHALCOGENIDES. Rediker, R. H.; Walpole, J. N. (Massachusetts Inst. of Tech., Cambridge). Aug 1972.

From special meeting on the physics of detectors; Orlando, Florida, USA (15 Mar 1972).

In proceedings of the special meeting on the physics of detectors. (Michigan Univ., Ann Arbor (USA). Infrared Information and Analysis Center).

New developments in the understanding of basic device parameters important to the operation of infrared lasers and detectors in the lead and lead-tin chalcogenides are reviewed. These include: (1) the diffusion parameters which determine the depth of p-n junctions, the concentration profiles near the junctions, and other parameters necessary for annealing and processing these non-stoichiometric compounds; (2) the high electric field transport properties which give information on the rates of impact ionization and the velocity saturation of charge carriers in junction devices; and (3) the surface properties which determine the ohmic or rectifying behavior of metal-semiconductor contacts and which permit an unusual metal-semiconductor minority carrier injection mechanism. (auth)

422 (LA-6009-MS) COLD CATHODE INVESTIGATION. Rink, J. P. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. Contract W-7405-eng-36. 5p. Dep. NTIS $4.00.

Experiments for the evaluation of a cold cathode electron gun are described. Different anode and cathode materials and configurations were tried. Small signal gains of 6.3 percent/cm were measured. It was found that the same small signal gains could be obtained with less energy deposition in the laser gas with the larger pre-ionizing currents from a cold cathode. Long-duration pulses were observed that were limited only by the electrical energy available in the Marx bank. (auth)

423 (LA-UR--75-1422) PULSED HYDROGEN FLUORIDE LASER OSCILLATOR-AMPLIFIER EXPERIMENTS. Schott, G. L. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 9p. (CONF-750666--1). Dep. NTIS $4.00.

From Seminar on Optical Methods in Energy Conversion; Rochester, New York, USA (23 Jun 1975).

Pulsed HF chemical laser oscillator energies were scaled from millijoules to several kilojoules over the period 1970-1974, reaching approximately 10 J with SF_6 and transverse discharges, and using electron-beam initiation and elemental F_2 above 1000J. This demonstrated scalability to large energy with acceptable electrical efficiency is only one prerequisite for application of this gas laser in fusion; equally important matters are achievement of focusable, approximately 1 ns pulses, couplable to light-element targets, all from an affordable system. Exploratory MOPA experiments are reported which address control of HF laser beam focusability and pulse duration, using SF_6-based experimental oscillator–amplifier sequences and Pockels' cell switching. Simultaneous multiline lasing with 2.6 less than or equal to lambda less than or equal to 3.1 mu m and high specific gain and energy density are particularly important factors encountered with HF, where amplifier pumping and lasing occur in a substantially cw temporal relationship, even in less than 100 ns bursts. Time-resolved SF_6–HI oscillator spectra contain 27 simultaneous lines from six vibrational bands. An apertured, SF_6-hydrocarbon pin-discharge oscillator generates approximately 10 mJ of TEM_{00} radiation, which is amplified to approximately 1 J in approximately 150 ns by a TEA amplifier and propagated tens of meters. A three-stage system coupling these elements through an approximately 1 ns electrooptic gate to a greater than 10 J, e-beam energized amplifier is under development. (auth)

424 (N-75-15971) INVESTIGATION OF LASER DYNAMICS, MODULATION, AND CONTROL BY MEANS OF INTRACAVITY TIME VARYING PERTURBATION. Semiannual Status Report, 1 August 1974–31 January 1975. Harris, S. E.; Siegman, A. E.; Kuizenga, D. J.; Kung, A. H.; Young, J. F.; Bekkers, G. E.; Bloom, D. M.; Newton, J. H.; Phillion, D. W. (Stanford Univ., Calif. (USA). Microwave Lab.). Feb 1975. 77p. (NASA-CR-142018; ML-2404). NTIS $4.25.

The generation of tunable visible, infrared, and ultraviolet light was examined, along with the control of this light by means of novel mode-locking and modulation techniques. Transient mode-locking of the Nd : YAG laser and generation of short tunable pulses in the visible and the alkali metal inert gas excimer laser systems were investigated. Techniques for frequency conversion of high power and high energy laser radiation are discussed, along with high average power blue and uv laser light sources. (auth)

425 (N-75-15972) RESEARCH ON FISSION FRAGMENT EXCITATION OF GASES AND NUCLEAR PUMPING OF LASERS. Schneider, R. T.; Davie, R. N.; Davis, J. F.; Fuller, J. L.; Paternoster, R. R.; Shipman, G. R.; Sterritt, D. E.; Helmick, H. H. (Florida Univ., Gainesville (USA)). Dec 1974. 181p. (NASA-CR-142019). NTIS $7.00.

Experimental investigations of fission fragment excited gases are reported along with a theoretical analysis of population inversions in fission fragment excited helium. Other studies reported include: nuclear augmentation of gas lasers, direct nuclear pumping of a helium-xenon laser, measurements of a repetitively pulsed high-power CO_2 laser, thermodynamic properties of UF_6 and UF_6/He mixtures, and nuclear waste disposal utilizing a gaseous core reactor. (STAR)

426 (N-75-17654) PASSIVELY COOLED GLASS CO_2 LASER TUBES FOR SEVERE ENVIRONMENTS. Walker, H. E.; Johnson, E. H. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Dec 1974. 25p. (NASA-TM-X-70824; X-720-74-354). NTIS $3.25.

The objective of this effort was to design a glass CO_2 laser tube that could survive the Titan 3 C launch environment and at the same time provide adequate thermal conductivity to maintain the wall of the laser tube below approximately equal to 50°C for efficient lasing. The approach that was taken to satisfy these requirements was to pot the tube in an aluminum heat sink using a space qualified polyurethane potting material. Two configurations of the laser tube successfully passed the complete Titan 3 C qualification level sine and random vibration specification and satisfied the thermal requirements. Fabrication details and test results are presented that indicate this could be a practical solution for laser tubes used in a severe environment and where flowing coolants are impractical or undesirable. (auth)

427 (NTIS/PS-75/015) METAL VAPOR LASERS (A BIBLIOGRAPHY WITH ABSTRACTS). Report for 1964–October 1974. Werner, K. G. (National Technical Information Service, Springfield, Va. (USA)). Jan 1975. 40p. NTIS $25.00.

The bibliography contains 35 selected abstracts of research reports retrieved using the NTIS on-line search system–NTISearch. It includes reports on metal atom, metal dimer and metal ion lasing, and metal vapor generators for lasers. (GRA)

428 (SAND-75-5630) HIGH POWER LASER EXCITER ACCELERATORS. Martin, T. H. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 17p. (CONF-751102-2). Dep. NTIS $4.50.

From international laser exposition and electrooptics '75; Anaheim, California, USA (11 Nov 1975).

Recent developments in untriggered oil and water switching now permit the construction of compact, high energy density pulsed power sources for laser excitation. These accelerators, developed principally for electron beam fusion studies, appear adaptable to laser excitation and will provide electron beams of 10^{13} to 10^{14} W in the next several years. The accelerators proposed for e-beam fusion essentially concentrate the available power from the outside edge of a disk into the central region where the electron beam is formed. One of the main problem areas, that of power flow at the vacuum diode insulator, is greatly alleviated by the multiplicity of electron beams that are allowable for laser excitation. A proposal is made whereby the disk-shaped pulsed power sections are stacked vertically to form a series of radially flowing electron beams to excite the laser gas volume. (auth)

429 (UCRL-77124) FINISHING OF PRECISION GENERATED METAL OPTICAL COMPONENTS. Baker, P. C.; Sonderman, J. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1975. 8p. (CONF-750852-2). Dep. NTIS $4.00.

From 19th annual technical symposium of the Society of Photo-Optical Instrumentation Engineers; San Diego, California, USA (18 Aug 1975).

Diamond turning and precision generation of aspheric metal surfaces has promoted a change in lapping techniques due to the extremely close figure tolerances and surface finishes that have been achieved. Special tooling, diamond abrasive, silicon oil and special techniques used to polish the unusual aspheric figures are described. The studies include small flat diamond turned samples of copper, electroplated copper, electroplated silver, electroplated nickel and silver as well as large aspheres such as an f/0.75, 35 cm dia copper ellipse. Results from cleaning studies on flat samples using ultrasonics and vapor degreasers are also summarized. Interferograms of wavefront distortion and analysis of focal volume are included as well as 10.6 mu m reflectivity and a summary of laser damage experiments. (TFD)

430 (UCRL-77197) HIGH-ENERGY GLASS LASERS. Glaze, J. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Aug 1975. 37p. (CONF-750852-3). Dep. NTIS $5.00.

From 19th annual technical symposium of the Society of Photo-Optical Instrumentation Engineers; San Diego, California, USA (18 Aug 1975).

In order to investigate intense pulse propagation phenomena, as well as problems in laser and system design, a prototype single chain laser called CYCLOPS was constructed. This laser employs a 20-cm clear aperture disk amplifier in its final stage and produces a terawatt pulse whose brightness exceeds 10^{18} watts/cm^2-ster. The CYCLOPS system is summarized and aspects of nonlinear propagation phenomena that are currently being addressed are discussed. (MOW)

431 EFFECT OF REFRACTIVE-INDEX NONLINEARITY ON THE OPTICAL QUALITY OF HIGH-POWER LASER BEAMS. Suydam, B. R. (Los Alamos Scientific Lab., NM). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 6, 225-230(Jun 1975).

Both small-scale and large-scale partial self-focusing produce phase distortions which result in loss of optical quality of the beam. Both effects are studied and both can result in significant power loss. Incipient fine-scale self-focusing losses can be mitigated by spatial filtering. Nonlinear lensing, i.e., partial large-scale self-focusing, is more or less serious depending on the size of the target onto which the beam is to be focused. (auth)

432 EFFECT OF ROTATIONAL AND INTRAMODE VIBRATIONAL COUPLING ON SHORT-PULSE AMPLIFICATION IN CO_2. Harrach, R. J. (Univ. of California, Livermore). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 349-357(Jul 1975).

The extraction of stored energy from a CO_2-laser amplifier by a short-duration input pulse is described using a rate-equation theory. The influence of rotational and intramode vibrational energy-transfer processes is studied as a function of the energy density E/sub in/ and width tau/sub p/ of the input pulse. By a suitable choice of normalized variables delta and E/sub in// E/sub sat/ for the extracted-energy and input-energy density, it is found that the results for different values of tau/sub p/ are interrelated by simple translations in a delta versus E/sub in// E/sub sat/ diagram. The characteristic curves in this diagram are nearly independent of the amplifier gain factor exp ($alpha_0$L) for high-gain systems. A comparison of the theory with experimental results of Figueira et al. shows satisfactory agreement and leads to an estimate of (1.0 to 3.5) 10^6 s^{-1} torr^{-1} for the rate of intramode vibrational–vibrational (VV) energy transfer in CO_2. (auth)

433 SATURATION MECHANISMS IN PC He--Cd$^+$ LASERS. Mizeraczyk, J. K. (Inst. of Fluid-Flow Machines, Gdansk, Poland). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 5, 218-220(May 1975).

The results of experimental studies on the saturation mechanisms in He–Cd laser discharge are presented. It is concluded that the saturation effects may be explained in terms of the influence of the discharge parameters on the helium triplet metastable density. (auth)

434 STIMULATED-EMISSION CROSS SECTION AND INVERSION LIFETIME IN A THREE-ATMOSPHERE IODINE PHOTODISSOCIATION LASER. Aldridge, F. T. (Univ. of California, Livermore). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 5, 215-218(May 1975).

An iodine photodissociation laser has been operated at three atmospheres by adding an inert gas to the laser medium. With three atmospheres of helium added a stimulated-emission cross section of 2 x 10^{-19} cm^2 and an inversion half-life of 110 mu s was observed. (auth)

435 NEW CW LINES FROM A SUBMILLIMETER WAVEGUIDE LASER. Radford, H. E. (Center for Astrophysics, Cambridge, MA). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 5, 213-214(May 1975).

Sixty-one new cw laser lines with wavelengths between 0.1 and 1.5 mm have been observed with a waveguide laser optically pumped by a CO_2 laser. (auth)

436 SPATIAL HOLE BURNING AND OLIGO-MODE DISTANCE CONTROL IN CW DYE LASERS. Hertel, I. V.; Stamatovic, A. S. (Universitat Trier-Kaiserslautern, Ger.). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 5, 210-212 (May 1975).

Spatial hole burning at the position of the dye cell is identified to be responsible for stable double-, triple-, and higher oligo-mode action in a narrow-band cw dye laser. This may be exploited systematically to control the mode distances by arranging the positions of both resonator end mirrors. A total output power up to over 100 mW is obtainable for double- or triple-mode action. Special conditions are described to obtain stable double-mode action with 1772-MHz mode spacing, as needed for simultaneous optical pumping of the two sodium hyperfine ground states. (auth)

437 SATURATION EFFECTS AND START JUMP OF GAUSSIAN MODES IN OSCILLATORS. Witteman, W. J.; Ernst, G. J. (Twente Univ. of Tech., Enschede, Netherlands). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 5, 198-204(May 1975).

The interaction of a Gaussian mode with a homogeneous and an inhomogeneous laser transition is described. The interaction of the beam with the medium in a laser is treated by taking into account the spatial distribution of both radiation and gain. The intensity characteristics are very different from those obtained for a one-dimensional interaction of a plane wave with a saturating medium. In the presence of a small-signal gain profile the threshold condition requires much higher inversion densities along the optic axis than by ignoring this profile. For gas lasers, for instance, having a small-signal gain profile that is approximately described by a zero-order Bessel function, the threshold inversion density can be about 50 percent higher. For high-power systems the saturation of the medium by the Gaussian intensity distribution results in a considerable amount of radial radiation transport. For homogeneous transitions this amount is about equal to the stimulated emission and for inhomogeneous transitions it is about half of it, independent of the beamwidth. Further, it is found that if one slowly passes the threshold condition for laser action, the intensity jumps from zero to a certain value and vice versa. This effect has also been verified experimentally. (auth)

438 THEORY OF OPTICAL-GAIN MEASUREMENTS. Cross, P. S.; Oldham, W. G. (Univ. of California, Berkeley). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 5, 190-197(May 1975).

The widely used technique for determining optical gain and absorption from single-pass, amplified spontaneous emission (ASE) is analyzed with particular attention given to active-volume saturation and three-dimensional effects. The results for homogeneously broadened media show that the population inversion and hence the gain in the active region is diminished by high levels of spontaneous and ASE. The externally measured gain is further reduced for large output collection apertures that admit incompletely amplified off-axis rays. Criteria are given for the excitation and detection geometries required to ensure accurate (approximately 10 percent) gain measurement. The simultaneous measurement of the equilibrium absorption coefficient can be made under less restrictive conditions. (auth)

439 FLUCTUATIONS IN MODE-LOCKING THRESHOLD DUE TO STATISTICS OF SPONTANEOUS EMISSION. Wilbrandt, R. (Atomic Energy Commission Risoe Research Establishment, Roskilde, Denmark); Weber, H. IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 5, 186-190(May 1975).

A passively mode-locked Nd : YAG oscillator operating in TEM_{00} mode is investigated theoretically and experimentally. It is shown that a mode-locking threshold well above the normal lasing threshold exists and that this second threshold is of a probabilistic nature. This means that mode locking at a given pump rate in the region of threshold occurs only with a certain probability due to the Gaussian statistics of spontaneous emission. Experiments agree qualitatively with theory. Furthermore, thermal effects in the liquid absorber are shown to play an important role in mode-locking systems; they introduce an additional time-dependent loss or gain, depending on the experimental setup. This can either lead to increase of mode-locking threshold or to the appearance of higher order transverse modes and possible damage of laser components. (auth)

440 CONTROLLED TIMEWISE REDISTRIBUTION OF LASER ENERGY. Panarella, E.; Bradley, L. L. T. (National Research Council, Ottawa). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 5, 181-185(May 1975).

An electronic feedback circuit is described which has been used in a Nd : glass high-power laser system for converting the spiky light emission into a smooth near-rectangular output of adjustable intensity and duration. The feedback circuit is also capable of converting the laser emission into a stroboscopic output of frequency of several hundreds of kilohertz or into a Q-switched high-intensity output. The attractive feature of the system is that the change from one type of laser operation into the other does not require any modification to the circuit, but only a simple readjustment of a few control knobs. The feedback system incorporates a high-current fast photodiode, a Pockels-cell shutter, and a pulser. The main innovation of the present electronic feedback circuit over previously proposed systems is the ability to set the Pockels cell at any point of its transmission curve. This feature will be demonstrated to be of decisive importance in smoothing out the laser emission and in converting the spiky light output into a series of periodic light pulses. (auth)

441 ROTATIONAL TEMPERATURE DETERMINATIONS IN MOLECULAR GAS LASERS. Weaver, L.A.; Taylor, L.H.; Denes, L.J. (Westinghouse Research Laboratories, Pittsburgh, Pennsylvania 15235). J. Appl. Phys. 46: No. 9, 3951-3958 (Sept 1975).

The small-signal gain expressions for vibrational-rotational transitions are examined in detail to determine possible methods of extracting the rotational temperature from experimental gain measurements in molecular gas lasers. Approximate values of T_r can be deduced from the rotational quantum numbers for which the P- and R-branch gains are maximum. Quite accurate values of T_r and the population inversion density $(n_{v'} - n_{v''})$ can be determined by fitting data to suitably linearized gain relationships, or by performing least-squares fits of the P- and R-branch experimental data to the full gain expressions. Experimental gain measurements for 15 P-branch and 12 R-branch transitions in the 10.4-μm CO_2 band have been performed for pulsed uv-preionized laser discharges in $CO_2 : N_2 : He = 1 : 2 : 3$ mixtures at 600 Torr. These data are subjected to the several gain analyses described herein, yielding a rotational temperature of 401 ± 10 °K and an inversion density of $(3.77 \pm 0.07) \times 10^{17}$ cm^{-3} for conditions of maximum gain. These techniques provide accurate values of the gas temperature in molecular gas lasers with excellent temporal and spatial resolution, and should be useful in extending the conversion efficiency and arcing limits of high-energy electrically excited lasers. (auth)

442 THREE-MODE EMISSION FROM A GAS LASER. II. STABILITY OF STEADY-STATE ASYMMETRIC EMISSION. Ermachenko, V.M.; Matskevich, V.K. (Moscow Engineering Physics Institute). Sov. J. Quantum Electron. 5: No. 2, 140-143 (Aug 1975).

The stability of steady-state three-mode emission of a gas laser is investigated for an asymmetric position of the modes relative to the center of the laser transition line. Allowance is made for depolarizing collisions. The intensities of the modes and of a small-beat signal are calculated as a function of frequency for different pressures in a gas mixture. The time dependences of the mode intensities are considered in the case when steady-state emission is unstable. (auth)

443 POSSIBILITY OF THE DEVELOPMENT OF A CF_3I GLOW-DISCHARGE LASER. Zalesskii, V.Yu.; Ivanov, M.G. Sov. J. Quantum Electron. 5: No. 2, 156-158 (Aug 1975).

The possibility of generation of laser radiation as a result of dissociation of CF_3I molecules is considered. The conditions for a population inversion of the active levels of the iodine atom are obtained. (auth)

444 INVESTIGATION OF THE OPERATION OF A RING LASER WITH A METHANE CELL. Andronova, I.A.; Bershtein, I.L.; Markelov, N.A. (Scientific-Research Radio Physics Institute, Gor'kii). Sov. J. Quantum Electron. 5: No. 2, 166-170 (Aug 1975).

An investigation was made of the operation of a ring laser ($\lambda = 3.39$ μ) with a methane cell in the case when the frequencies of the opposite waves were split in the presence of a power peak. A method was developed for obtaining a smooth profile of the peak, locking of the half-sum of the wave frequencies to the average frequency of the absorption line of methane was confirmed, and automatic frequency stabilization was achieved. (auth)

445 STRUCTURE OF ACTIVE COMPLEXES IN $POCl_3$–$SnCl_4$–Nd^{3+}. Levkin, L.V.; Ral'chenko, V.I. (Institute of Radio Engineering and Electronics, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 2, 176-179 (Aug 1975).

A comparison was made of the Stark splittings of the $^4I_{9/2}$, $^4I_{11/2}$, and $^4F_{3/2}$ levels of Nd^{3+} active centers in several matrices containing phosphorus. It was found that the Stark sublevels of one of the active centers in the $POCl_3$–$SnCl_4$–Nd^{3+} inorganic laser liquid were close to the neodymium sublevels in NdP_5O_{14}. Hence, the data on the structure of active complexes in NdP_5O_{14} were used in the development of a model of the structure of type A active centers in $POCl_3$–$SnCl_4$–Nd^{3+} and in estimating the parameters of these centers. (auth)

446 NATURE OF THE INFLUENCE OF THE PRESSURE IN A MIXTURE ON THE STIMULATED EMISSION OF A CHEMICAL CARBON MONOXIDE PULSE LASER. Gordon, E.B.; Moskvin, Yu.L.; Pavlenko, V.S.; Tal'roze, V.L. (Institute of Chemical Physics, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 2, 185-187 (Aug 1975).

The results are given of an experimental investigation of the characteristics of a chemical CO pulse laser based on the photoinitiated reaction CS_2+O_2. These characteristics are found as a function of the dilution of the active mixture with various gases (He, Ar, Xe, CO_2, N_2O, OCS). A trimolecular chemical process is the cause of the quenching of the laser action at higher pressures in the mixture. The relative efficiencies of various molecules as the third bodies in this process are determined. The existence of a fast chemical chain reaction in the CS_2+O_2 system is postulated. (auth)

447 CORRELATION METHODS FOR INVESTIGATING THE PARAMETERS OF RADIATION EMITTED BY A MODE-LOCKED LASER. Dneprovskii, V.S.; Silina, E.K.; Khattatov, V.U. (M. V. Lomonosov State University, Moscow). Sov. J. Quantum Electron. 5: No. 2, 204-206 (Aug 1975).

Descriptions are given of two methods for measuring the effective duration of ultrashort pulses: One is based on the two-photon efficiency in a semiconductor correlator and the other is based on the reactive effect in second-harmonic generation. These methods were used to study the output parameters of a mode-locked laser with ring and linear resonators. (auth)

448 HELIUM-NEON RING LASER WITH A NEON ABSORPTION CELL. Danileiko, M.V.; Kozubovskii, V.R.; Nedavnii, A.P.; Shpak, M.T. (Institute of Physics, Academy of Sciences of the Ukrainian SSR, Kiev). Sov. J. Quantum Electron. 5: No. 2, 228-229 (Aug 1975).

A resonance of the absorption in neon was observed in a He–Ne laser at $\lambda=3.39$ μ. The resonance curve width was less than the radiation linewidth and the contrast was up to 20%. Such absorption resonances in a ring gas laser could be used in very-high-resolution spectroscopy. (auth)

449 SWITCHING OF THE EMISSION WAVELENGTH OF A HELIUM-NEON LASER IN THE 3.39 μ REGION. Balakin, V.A.; Konovalov, I.P.; Ocheretyanyi, A.I.; Popov, A.I.; Protsenko, E.D. (Moscow Engineering-Physics Institute). Sov. J. Quantum Electron. 5: No. 2, 230-231 (Aug 1975).

The emission switched from the $\lambda_0=3.3922$ μ $5s'[1/2]^0_1$–$4p'$ $[3/2]_2(3s_2-3p_4)$ line to the $\lambda_1=3.3912$ μ $5s'[1/2]^0_1$–$4p'[1/2]_1$ $(3s_2-3p_2)$ line in such a way as to maximize the power at the λ_1 wavelength. The absorption of both lines was determined in pure methane in the pressure range 0.05–1 atm and in methane-air mixtures at atmospheric pressure; a comparison was made of the gains of these lines in a helium-neon discharge. (auth)

450 HELIUM-NEON WAVEGUIDE LASER. Gonchukov, S.A.; Kornilov, S.T.; Petrovskii, V.N.; Protsenko, E.D.; Rubezhnyi, Yu.G. (Moscow Engineering-Physics Institute). Sov. J. Quantum Electron. 5: No. 2, 232-233 (Aug 1975).

An investigation was made of the properties of the $\lambda=3.39$ μ radiation emitted by a He–Ne waveguide laser. The dependences of the output power on the resonator geometry, pressure, and composition of the gas mixture were determined. The spectrum of the output radiation was investigated. An unsaturated gain of 170 dB/m per pass was achieved for a laser with a discharge tube in which the waveguide channel was of 510 μ diameter. (auth)

451 RELATIONSHIP BETWEEN THE LUMINESCENCE ENERGIES OF DIFFERENT TRANSITIONS FROM A METASTABLE LEVEL OF NEODYMIUM IONS IN GLASSES. Dianov, E.M.; Karasik, A.Ya.; Kornienko, L.S. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 2, 244-245 (Aug 1975).

A determination was made of the relationship between the luminescence energies of the transitions from the $^4F_{3/2}$ metastable state to the $^4I_{9/2}$, $^4I_{11/2}$, and $^4I_{13/2}$ levels of Nd^{3+} in silicate and phosphate glasses, characterized by a high directionality of laser radiation. The results of these measurements were compared with the data obtained for some mass-produced glasses. It was found that the variation of the composition within one base could alter the ratio of the luminescence energies of the two main bands (corresponding to the transitions from $^4F_{3/2}$ to $^4I_{9/2}$ and $^4I_{11/2}$) by 10–15% and when the base of the glass was altered, this ratio could change by 30–35%. (auth)

452 EMISSION SPECTRUM OF A CARBON DIOXIDE LASER WITH PASSIVE Q SWITCHING. Vasilenko, L.S.; Dyuba, N.M.; Skvortsov, M.N.; Chebotaev, V.P. (Institute of Physics of Semiconductors, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk). Sov. J. Quantum Electron. 5: No. 2, 246-247 (Aug 1975).

An experimental study was made of the emission spectrum of a CO_2 laser with passive Q switching. It was found that the phase memory was retained from pulse to pulse, i.e., the emission spectrum was similar to the spectrum of a continuous amplitude-modulated signal. This should open up new applications of Q-switched lasers in coherent signal processing systems. (auth)

453 CONTINUOUSLY OPERATING HIGH-PRESSURE CARBON DIOXIDE LASER WITH A TUNING RANGE OF 800 MHz. Beterov, I.M.; Provorov, A.S.; Chebotaev, V.P. (Institute of Physics of Semiconductors, Siberian Branch, Academy of Sciences of the USSR, Kovosibirsk). Sov. J. Quantum Electron. 5: No. 2, 257-258 (Aug 1975).

An investigation was made of the conditions for the maximum tuning range of the emission frequency of a cw high-pressure CO_2 laser. A tuning range of $\sim$800 MHz was obtained experimentally for several vibration-rotational transitions in the CO_2 molecule. Theoretical estimates were made of the maximum tuning range and optimum pressure. The experimental and theoretical results were compared. (auth)

454 EXPERIMENTAL INVESTIGATION OF THE DEPENDENCES OF THE COLLISION BROADENING AND SHIFT OF THE EMISSION LINE OF A MERCURY LASER ON He AND Ne PRESSURES. Bikmukhametov, K.A.; Klement'ev, V.M.; Chebotaev, V.P. (Institute of Semiconductor Physics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk). Sov. J. Quantum Electron. 5: No. 3, 278-281 (Mar 1975).

An experimental investigation was made of the impact (collision) broadening and shift of a mercury laser emission line representing the 6 $p^3P^0_2 \rightarrow 7s^3S_1$ ($\lambda=1.53$ μ) transition as a function of helium and neon pressures. The boradening of the mercury line varied at a rate of 16 MHz/mm Hg with the helium pressure and at a rate of 10.5 MHz/mm Hg with the neon pressure. Direct measurements indicated that the line was shifted in the direction of the violet side of the spectrum. The rate of shift with the helium pressure was 1.8 MHz/mm Hg and that with the neon pressure was 1.2 MHz/mm Hg. A comparison of the Hg–He and Hg–Ne interactions indicated that in both cases this interaction was the same and was described by the Lennard–Jones potential. Simultaneous measurements of the broadening and shift gave the values of the phenomenological constants C_6 and C_{12}, whose orders of magnitude were in agreement with the impact (collision) theory. An estimate was obtained of the lifetime of the $6p^3P^0_2$ level, which was $\sim 2\times10^{-7}$ sec. (auth)

455 INVESTIGATION OF PULSE INFRARED STIMULATED EMISSION FROM BARIUM VAPOR. Isaev, A.A.; Kazaryan, M.A.; Markova, S.V.; Petrash, G.G. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 3, 285-287 (Mar 1975).

Stimulated infrared emission due to 13 transitions in barium vapor was obtained as a result of pulse excitation of a discharge. The stimulated emission was mainly due to transitions from a resonance to a metastable level. The integrated average output power was 1.6 W and the efficiency was 0.28%. (auth)

456 SINGLE-FREQUENCY Q-SWITCHED NEODYMIUM LASER. Egorov, A.L.; Korobkin, V.V.; Serov, R.V. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 3, 291-293 (Mar 1975).

Reliable emission of one longitudinal and lowest transverse mode from a Q-switched neodymium laser was achieved using a specially designed resonant reflector as the exit mirror. This reflector acted as a longitudinal mode selector. The method used to design this selector is described and the characteristics of a single-frequency laser utilizing such a selector are reported. (auth)

457 SPONTANEOUS FLUCTUATIONS OF THE EMISSION FROM A LASER WITH A TRANSVERSELY INHOMOGENEOUS FIELD DISTRIBUTION. Pyshkin, O.S.; Ratner, A.M.; Rom-Krichevskaya, I.A.; Chernov, V.S. (Physicotechnical Institute of Low Temperatures, Academy of Sciences of the Ukrainain SSR, Kiev). Sov. J. Quantum Electron. 5: No. 3, 319-322 (Mar 1975).

An investigation is made of the influence of a transverse macroinhomogeneity in a solid state laser on the emission kinetics. It is shown that when a fairly definite minimum is located in the central part of the transverse intensity distribution, the emission is in the form of spontaneous fluctuations whose growth increment increases with increasing depth of this minimum. The results obtained are in agreement with the experimental data on the correlation between the transverse field distribution and the laser emission kinetics. (auth)

458 INVESTIGATION OF AN YTTERBIUM VAPOR LASER. Klimkin, V.M. (Institute of the Optics of the Atmosphere, Siberian Branch, Academy of Sciences of the USSR, Tomsk). Sov. J. Quantum Electron. 5: No. 3, 326-329 (Mar 1975).

An investigation was made of the excitation conditions, and of the energy and time parameters of several stimulated emission lines of ytterbium vapor. Positions of the laser transitions in the ytterbium spectrum were determined and population inversion mechanisms were considered for the first excited states of the ytterbium atoms. Stimulated emission of six new lines was observed. (auth)

459 SPATIAL INHOMOGENEITY OF INVERSION AND UNDAMPED PULSATIONS OF SOLID-STATE LASERS. Antsiferov, V.V.; Gainer, A.V.; Komarov, K.P.; Folin, K.G. (Institute of Physics Problems, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk). Sov. J. Quantum Electron. 5: No. 3, 332-337 (Mar 1975).

An analogy is suggested between the emission of radiation from a solid-state laser and the frictional motion of a particle in a potential well. This analogy is used to demonstrate analytically that a system of rate equations which allows only for the spatial inhomogeneity of the population inversion fails to describe the undamped pulsation regime. It is shown that this inhomogeneity makes the emission much more sensitive to perturbations in a real resonator. A comparison of the theoretical and experimental results is used to demonstrate the existence of a mechanism which generates undamped pulsations but is not related to laser instabilites. (auth)

460 POPULATION INVERSION OF ROTATIONAL LEVELS OF DIATOMIC MOLECULES DUE TO ADIABATIC EXPANSION OF A GAS. Vargin, A.N.; Ganina, N.A.; Konyukhov, V.K.; Lukovnikov, A.I.; Selyakov, V.I. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 3, 338-340 (Mar 1975).

It is shown for the first time that a population inversion of rotational levels of diatomic molecules can be obtained as a result of adiabatic expansion of a gas mixture. The inversion is a consequence of the kinetics of the rotational relaxation of molecules in a monatomic gas. The results of numerical calculations are given for different conditions of flow of HCl+He mixtures and allowance is made for one- and two-quantum collisional transitions. One-quantum radiative transitions from inverted levels $j=13$–20 are found to be located in the wavelength range $\lambda=40$–20 μ. (auth)

461 EXTRACTION OF RADIATION FROM AN ELECTRON-BEAM-EXCITED SEMICONDUCTOR LASER THROUGH A DIFFRACTION GRATING. Goncharov, I.G.; Dedushenko, K.B.; Kozhevnikov, A.V.; Luk'yanov, V.N.; Uzkii, A.F.; Shveikin, V.I.; Shelkov, N.V.; Yakubovich, S.D. (Moscow Engineering-Physics Institute). Sov. J. Quantum Electron. 5: No. 3, 352-352 (Mar 1975).

A diffraction grating, deposited on the active-layer surface, was used to extract radiation from an electron-beam-excited GaAs laser at 77 °K. The angular distribution of the output radiation consisted of two lobes of 0.5° half-width inclined by 1.6° with respect to the normal. (auth)

462 FOUR-PHOTON PARAMETRIC AMPLIFICATION IN SEMICONDUCTORS. Jain, M.; Gersten, J.; Tzoar, N. (Department of Physics, City College of the City University of New York, New York, New York 10031). J. Appl. Phys. 46: No. 9, 3969-3974 (Sept 1975).

A theoretical study of four-photon parametric amplification in narrow-band-gap semiconductors is made. It is shown that phase matching is achievable in a linear geometry if a magnetic field is employed. Furthermore, a substantial cyclotron resonance enhancement occurs in the presence of a magnetic field. We calculate the growth rates and threshold fields associated with the parametric amplification and conclude that an efficient laser may be designed based on this process. (auth)

463 SHORT PULSES TUNABLE IN THE 0.69–0.99-μ RANGE FROM N_2 LASER PUMPED DYE SOLUTIONS. Lin, C. (Bell Telephone Laboratories, Holmdel, New Jersey 07733). J. Appl. Phys. 46: No. 9, 4076-4077 (Sept 1975).

Subnanosecond pulses tunable in the 0.69–0.96-μ range, and nanosecond pulses tunable up to 0.99 μ, have been obtained from N_2 laser ($\lambda=337$ nm) pumped dye lasers. These are achieved as a result of the recent availability of new efficient near-ir laser dyes for direct uv pumping, and the application of the technique of controlled resonator transients. (auth)

464 SELF-MODE-LOCKING OF AN IODINE PHOTODISSOCIATION LASER. Pirkle, R.J. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14853); Davis, C.C.; McFarlane, R.A. J. Appl. Phys. 46: No. 9, 4083-4085 (Sept 1975).

The observation of self-mode-locking of an iodine photodissociation laser is reported. A typical laser output takes the form of a train of fully or partially mode-locked relaxation spikes. Simultaneous oscillation on at least eight longitudinal modes and locking of both longitudinal and transverse modes have been observed. (auth)

465 COHERENCE LENGTH OF A *Q*-SWITCHED Nd:YAG LASER. Barnes, N.P.; Crabbe, I.A. (Martin Marietta Aerospace, Orlando, Florida 32805). J. Appl. Phys. 46: No. 9, 4093-4095 (Sept 1975).

The coherence length of a *Q*-switched Nd:YAG laser was measured as a function of the ratio of input energy to threshold input energy. The coherence length was determined by photographing, with the aid of an image converter, the fringes produced by a Michelson interferometer. It was found that both the coherence length and the visibility at zero pathlength difference decreased as the ratio of input energy to threshold input energy was increased. The longest coherence length measured was 16.8 mm at a ratio of input energy to threshold input energy of 1.33. (auth)

466 USE OF INTENSE RELATIVISTIC ELECTRON BEAMS TO PUMP VUV LASERS. Whitney, K.G. (Science Applications Incorporated, McLean, Virginia 22101); Davis, J. J. Appl. Phys. 46: No. 9, 4103-4105 (Sept 1975).

Evidence is given to suggest that intense relativistic electron beams will find application as energy sources for pumping high-power vacuum ultraviolet lasers. A simple model of a stationary oxygen plasma was set up. When pulse heated, the plasma underwent a temperature evolution in close correspondence with measured values obtained in a plasma-heating experiment using a pulsed relativistic electron beam. In addition, a transient gain sufficient to produce amplified spontaneous emission (ASE) was calculated for the $3p \rightarrow 3s$ transitions in O III. The width of the gain curve was comparable to the width of experimentally measured uv laser pulses produced from an oxygen plasma having roughly the same density as in the plasma-heating experiment. (auth)

467 STIMULATED EMISSION FROM CO^+ PUMPED BY CHARGE TRANSFER FROM He^+_2 IN THE AFTERGLOW OF AN e-BEAM DISCHARGE. Waller, R.A.; Collins, C.B.; Cunningham, A.J. (University of Texas at Dallas, Box 688, Richardson, Texas 75080). Appl. Phys. Lett. 27: No. 6, 323-325 (15 Sept 1975).

Stimulated emission from the $B^2\Sigma$ state of CO^+ has been observed as a consequence of the charge transfer reaction between He^+_2 and CO in the afterglow of a Febetron 706 discharge into 3 atm of helium containing 1.0 Torr of carbon monoxide. Peak gains of the order of 0.08 cm^{-1} were found for the (0,2) vibrational component of the $B^2\Sigma \rightarrow X^2\Sigma$ transition at 2470 Å by directly measuring the time-resolved amplification of suitably filtered light from a xenon flashlamp. Correspondingly smaller gain, persisting for several hundred nanoseconds, was found for the (0,0) and (0,1) vibrational components of the $B^2\Sigma \rightarrow A^2\Pi$ transitions at 3954 and 4210 Å, respectively. (auth)

468 FILAMENTS IN SEMICONDUCTOR LASERS. Ripper, J.E.; Nunes, F.D.; Patel, N.B. (Instituto de Fisica "Gleb Wataghin", Universidade Estadual de Campinas, Campinas, Sao Paulo, Brasil). Appl. Phys. Lett. 27: No. 6, 328-330 (15 Sept 1975).

Filament profiles in cw stripe-geometry homostructure GaAs lasers are measured from below to well above threshold through their optical spectra. It is shown that the filament appears well below threshold and its dimensions are not a strong function of injection level and consequently of the optical field intensity. These results are at variance with previously published theories. (auth)

469 FREQUENCY-CONTROLLED cw TUNABLE GaAs LASER. Picqué, J.; Roizen, S. (Laboratoire Aimé Cotton, C.N.R.S. II, Batiment 505, 91405-Orsay, France). Appl. Phys. Lett. 27: No. 6, 340-342 (15 Sept 1975).

A cw single-mode tunable GaAs diode laser has been locked to an external passive cavity by making use of the dependence of the output frequency on the injection current. The resulting long-term stability of the laser optical frequency was checked by reference to a microwave frequency standard, through the light-shift effect in a cesium vapor. The laser frequency was found to track the drift of the cavity bandpass with residual variations less than 300 kHz rms. Servo-controlled frequency scanning was achieved over 5 GHz. (auth)

470 DOUBLE-WAVELENGTH LASER. Lotem, H.; Lynch, R.T., Jr. (Gordon McKay Laboratory, Harvard University, Cambridge, Massachusetts 02138). Appl. Phys. Lett. 27: No. 6, 344-346 (15 Sept 1975).

A new technique is reported which allows a laser to operate simultaneoulsy at two or more wavelengths from a high-gain grating- or prism-tuned laser. This is done by inserting a small-angle wedge in the laser to form two independent cavities. The relative intensities at the output wavelengths are governed by the wedge location. Tuning of the new wavelength is accomplished by rotating the wedge. The difference frequency between the two output wavelengths is not limited by the gain characteristics of the active medium since different active media can be used simultaneously. The wedge technique was used in a nitrogen-laser-pumped dye laser and the usefulness of such a laser in nonlinear optical experiments was shown. (auth)

471 GENERATION OF SINGLE-PICOSECOND DYE LASER PULSES USING ONE- AND TWO-PHOTON TRAVELING-WAVE EXCITATION. Rubinov, A.N.; Richardson, M.C.; Sala, K.; Alcock, A.J. (Division of Physics, National Research Council of Canada, Ottawa, Canada). Appl. Phys. Lett. 27: No. 6, 358-360 (15 Sept 1975).

Single-photon and two-photon traveling-wave excitation of superradiant emission in Rhodamine 6G by single-picosecond 1.06-μ laser pulses is reported. In addition, results are presented on the application of optical Kerr-effect photography to a time-resolved spectroscopic study of the dye laser emission. (auth)

472 THE POSSIBILITY OF AN EFFICIENT TUNABLE MOLECULAR IODINE LASER NEAR 340 nm. McCusker, M.V.; Hill, R.M.; Huestis, D.L.; Lorents, D.C.; Gutcheck, R.A.; Nakano, H.H. (Stanford Research Institute, Menlo Park, California 94025). Appl. Phys. Lett. 27: No. 6, 363-365 (15 Sept 1975).

We have observed intense band emissions between 340 and 344 nm from electron-beam-excited mixtures of high-pressure argon gas and iodine vapor. This emission appears to be from molecular iodine. Using the 357.6-nm band from an Ar/N_2 mixture as a calibration, we have measured the fluorescence yield in this wavelength region to be 70±24%. From this we computed an over-all fluorescence energy efficiency of 13±4%. Based on these observations, we suggest the feasibility of an efficient high-energy electron-beam-pumped argon-iodine laser. The gain of such an argon-iodine laser should be comparable to that of the Ar/N_2 second positive laser. (auth)

473 LASING DYNAMICS OF A YAG-Nd^{3+} LASER WITH A ROTATING PLATE IN THE RESONATOR. Belousov, N.D.; Skorobogatov, B.S. Opt. Spectrosc. (USSR) 38: No. 5, 591-592 (May 1975).

Using a rotating glass plate, the optical length of the dynamic resonator of a YAG-Nd^{3+} laser was varied. Among the effects observed were undamped pulsations in the laser radiation intensity and an increase in the amplitude of the spikes in the resonator. (AIP)

474 LASING IN A He—Ne LASER AT FORCED FREQUENCIES IN A BAND 70 kHz WIDE. Zapryagaev, A.F. Sov. Phys.—Tech. Phys. 20: No. 1, 130-131 (July 1975).

Experiments are described in which laser action is observed in a He—Ne laser at forced frequencies in a band about 70 kHz wide. Here, "forced frequencies" means frequencies excited in the laser when the latter is optically coupled to a moving reflector. Frequency pulling of the longitudinal modes occurs. Signals at combination frequencies are excited in the neighborhood of one of the characteristic frequencies of the resonator; these occupy a narrower band than the forced frequencies. (auth)

475 DISTRIBUTED-FEEDBACK COUPLING IN $Ga_{1-x}Al_xAs$ DOUBLE-HETEROSTRUCTURE LASERS: EFFECT OF ALUMINUM CONCENTRATION. Boyd, J.T.; Anderson, D.B. (Electronics Research Division, Rockwell International Corporation, Anaheim, California 92803). Appl. Opt. 14: No. 9, 2199-2202 (Sept 1975).

The variation of the feedback coupling coefficient in $Ga_{1-x}Al_xAs$ distributed-feedback (DFB) lasers as a function of the Al concentration surrounding the GaAs optical confinement waveguide is considered. An optimum thickness for which the feedback coupling is maximum is determined for each transverse mode. The largest such maximum occurs for the lowest order mode. Fractional Al concentrations that yield symmetrical optical waveguides are found to be most effective in minimizing threshold current density, with the maximum Al concentrations being limited by doping and lattice mismatch considerations. (auth)

476 QUASI-STATIONARY POPULATION INVERSION ON K α TRANSITIONS. Elton, R.C. (U. S. Naval Research Laboratory, Washington, D.C. 20375). Appl. Opt. 14: No. 9, 2243-2249 (Sept 1975).

In a search for an x-ray laser capable of operating in a quasi-cw mode, a suggested *K*α-innershell scheme is examined using recently calculated rates. This scheme involves the decay of a *K*-shell vacancy followed by a more rapid (for certain elements) *L*-vacancy decay, which maintains the inversion. The present analysis indicates that the scheme is only marginally feasible unless a depletion of resonant absorbers is accomplished through line shifts associated with multiple ionization following *K*-vacancy production. The pumping requirements for overcoming photoionization losses in the beam and the associated gain conditions are estimated for three elements, namely silicon, calcium, and copper, and it is concluded that photoionization pumping in a selective energy band is required, with emission approaching the blackbody level. A multiline heavy-ion plasma source is suggested. (auth)

477 ELECTRON BEAM-PUMPED SEMICONDUCTOR $Al_{1-x}Ga_{1-y}Sb$ LASER. Akimov, Yu. A.; Burov, A. A.; Zagarinskii, E. A.; Kryukova, I. V.; Petrushenko, Yu. V.; Stepanov, B. M. (All-Union Scientific Research Inst. of Physical-Optical Measurements, Moscow). Kvantovaya Elektron. (Moscow); 2: No. 1, 68-72(Jan 1975). (In Russian).

Stimulated emission for an $Al_xGa_{1-x}Sb$ solid solution subjected to electron-beam pumping and liquid nitrogen cooling is reported for the first time. Coherent radiation was obtained throughout the composition region where the semiconductor maintains its direct band structure within the range 1.1 to 1.6 μm. The dependence of the width of the forbidden zone E_g on composition x of the solid solution was established. The point of conversion from the direct to the indirect zone structure was determined (x_c [c = conversion] ≈ 0.25, E_c ≈ 1.145 eV). It is shown that some discrepancy between the experimental data and the graphical data of the plot of the function $E_g(x)$ was due to the effect of donor levels ($E_d \approx 20$ meV) near the indirect L-minimum. The parameters of a sealed semiconductor laser with electron beam pumping constructed of this material are presented. Total accelerating voltage is up to 50 to 60 kV. Beam current in crystal plane is up to 0.45 A. Current density is up to 15 A/cm^2. The laser radiation strength (for pulse width 10^{-7} sec) is up to 60 W. The position of the emission spectrum maximum is 1.12 to 1.59 μm. (JPRS)

478 SHORTENING OF PICOSECOND Nd GLASS LASER EMISSION PULSES. Gordeev, E. M.; Kryukov, P. G.; Matveets, Yu. A.; Stepanov, B. M.; Fanchenko, S. D.; Chekalin, S. V.; Sharkov, A. V. (Inst. of Spectroscopy, Moscow). Kvantovaya Elektron. (Moscow); 2: No. 1, 205-209(Jan 1975). (In Russian).

A neodymium glass rod 180 mm in length and 10 mm in dia. was used to attempt to obtain single ultrashort laser generation pulses with duration shortened through suppression of the regenerative spectral narrowing. The laser generated a train of ultrashort pulses about 500 nsec in duration, with a total energy of about 10^{-3} J. The half-width of a pulse was 2.5 psec. A properly adjusted mode selector in the cavity was used in spectral narrowing. The picochron image converter was employed in producing pulses as short as 2.5 psec. (JPRS)

479 KVANTOVAYA ELEKTRONIKA I LAZERNAYA SPEKTROSKOPIYA. (Quantum Electronics and Laser Spectroscopy). Samson, A. M. (ed.). Minsk; Izdatel'stvo Nauka (1974). 512p.

The monograph deals with the study of the properties of lasers and methods of controlling their radiation characteristics, and also the interaction of laser radiation with matter and diagnostics of various physical objects. (Ref. Zh.)

480 ELECTRIC-DIPOLE VECTOR MODEL OF THE RUBY LASER TRANSITION TAKING ACCOUNT OF THE CRYSTAL STRUCTURE. Noda, Y. Oita Daigaku Gakugeigakubu Kenkyu Kiyo, Shizenkagaku; 4: No. 4, 59-62(1974). (In Japanese).

In a previous paper, an ellipsoid model of the electric dipole vector in a ruby laser was introduced. This model is useful to explain the polarization phenomena of the ruby laser both qualitatively and quantitatively. In this paper a vector model of ruby laser transition is given. This model is introduced by considering the crystal structure of ruby qualitatively. In this model, the theoretical calculation of the absorption coefficient of both polarizations is more simplified than in the previous model. (auth)

481 TRANSISTOR OSCILLATOR FOR PUMPING A SEMICONDUCTOR INJECTOR LASER. Kusurgashev, S. V. Instrum. Exp. Tech.; 18: No. 1, 190-192(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 165-166(1975).

A transistor pulse generator is described for pumping a semiconductor injection laser. The generator includes a step-down transformer operating at room temperature and has a resistance of 11 Ω. The generator produces pumping current pulses of rectangular shape at a repetition frequency of up to 3 kHz. The amplitude of the current pulses can be varied from 5 to 13 A, and the pulse length can be varied from 50 to 300 nsec. The rise time of the pulses is 10 to 20 nsec, and the fall time is 5 to 15 nsec. (auth)

482 HIGH-SPEED RADIATION DETECTOR FOR CO_2 LASERS BASED ON A POINT CONTACT OF METAL—OXIDE—METAL. Dolgopolov, S. G.; Klement'ev, V. M.; Shishaev, A. V. (Inst. of Semiconductor Physics, Novosibirsk, USSR). Instrum. Exp. Tech.; 18: No. 1, 221-222(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 191-192(1975).

A detector head, based on a point diode of the metal—oxide—metal type is described, for investigating the radiation characteristics of pulsed CO_2 lasers. The results are given of a comparison of the time characteristics of the detector with a commercial Ge : Au photoresistor. The sensitivity of the detector was not worse than 10 mV/kW, with a time constant of $\leq 4 \times 10^{-8}$ sec. (auth)

483 POWERFUL SOURCE FOR GAS-DISCHARGE LAMPS WITH INCREASED PULSE REPETITION RATE. Bomko, A. G.; Vakulenko, V. M. Instrum. Exp. Tech.; 18: No. 1, 295(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 250(1975).

Effective power sources exist for solid-state lasers with discharge pulse repetition rates up to 100 Hz. The development of pulsed power sources with pulse repetition rate >100 Hz is associated with difficulties, the principal ones being: (1) the necessity of building a regulating inverter; (2) the installation of cumbersome buffer capacitor bank at the inverter output; and (3) limited lifetime of gas-discharge lamps with pulsed operation. A new method of feeding pulsed discharge lamps is described. The method is based on charging a tank circuit from a source of rectified pulsed voltage up to a given energy level, with subsequent transfer of magnetic energy of the choke coil to a storage con-

denser. The storage condenser discharges into the gas-discharge lamp operating in the "pilot arc" regime. The main advantage of this method is the absence of a voltage regulator and buffer capacitor bank while the level of stabilization of the pump energy is maintained. (auth)

484 HIGHLY STABLE cw CO_2 LASERS OBTAINED BY AUTOMATIC FREQUENCY CONTROL. Kompanets, O. N.; Kukudzhanov, A. R.; Mikhailov, E. L. Instrum. Exp. Tech.; 18: No. 1, 296-297(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 250-251(1975).

The technical characteristics of sealed-off CO_2 lasers with a useful life of >1000 h, the method of calculating the systems parameters of the frequency control loop, and the experimental characteristics of the system's elements are described. (TFD)

485 RING FINE-FILM LASER WITH WAVEGUIDE PUMPING. Deryugin, L. N.; Cheremiskin, I. V.; Chekhlova, T. K. (Univ. of International Friendship, Moscow). Kvantovaya Elektron. (Moscow); No. 4, 794-798(1975). (In Russian).

Experiments conducted to study thin-film ring lasers with 6Zh rhodamine are described. In these lasers, the pumping radiation is propagated along a waveguide forming a ring resonator. The pumping radiation is almost completely used in this type of construction such that the efficiency approaches 100%. The values of the wave-front velocity in the experiments were 10^8 to 10^9 cm/s depending on the concentration of the dye. At these velocities, the light wave illuminated the full length of the resonator ring for a time period much less than the width of the pumping pulse, which was 1.5×10^{-7} s. A diagram of the experimental apparatus is given and its operation explained. The minimum pumping power for this type of laser with practically all of the pumping radiation used is calculated to yield a result of approximately one W. (JPRS)

486 SIMULTANEOUS TWO-WAVELENGTH OUTPUT OF A N_2-PUMPED DYE LASER. Schmidt, A. J. (Univ. of California, Berkeley). Opt. Commun.; 14: No. 3, 294-295(Jul 1975).

A simple method for generating a dual wavelength output of a N_2-laser pumped dye laser is described. A wedge placed in front of the tuning grating intersects only part of the cross-section of the light beam. Therefore, feedback is provided for two different wavelengths simultaneously. (auth)

487 MULTIBAND CO_2 OSCILLATOR. Schappert, G. T.; Figueira, J. F. (Los Alamos Scientific Lab., NM). Opt. Commun.; 13: No. 2, 104-105(Feb 1975).

Multiband output from an atmospheric CO_2 laser has been achieved with intercavity gaseous absorbers. SF_6, NH_3, NH_2D and butane are suitable for this purpose. (auth)

488 AMPLIFICATION OF THE 1.32-mu m LINE IN Nd:YAG. Loree, T. R. (Los Alamos Scientific Lab., NM); Sherman, L. M.; Thorne, J. M. IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; 371-372(Jul 1975).

Single-pass amplifier gains at 1.32 mu m have been measured in an 80-mm Nd:YAG rod, achieving a saturated gain of 3.1. Small-signal gain comparisons imply a stimulated-emission cross-section ratio (1.32/1.06 mu m) of 0.19. (auth)

489 STIMULATED-EMISSION CROSS SECTION AND INVERSION LIFETIME IN A THREE-ATMOSPHERE IODINE PHOTODISSOCIATION LASER. Aldridge, F. T. (Univ. of California, Livermore). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; 215-217(May 1975).

An iodine photodissociation laser has been operated at three atmospheres by adding an inert gas to the laser medium. With three atmospheres of helium added a stimulated-emission cross section of 2×10^{-19} cm^2 and an inversion half-life of 110 mu s was observed. (auth)

490 REFLECTIVE OPTIC SYSTEMS FOR LASERS. Enzmann, R. D.; Enzmann, J. M. (Northeast Cryonics, Corp., Lexington, MA). Ann. N. Y. Acad. Sci.; 251: 346-357(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

Herein are introduced new reflective optic systems using, in sequence, expanders, adders, compressors, amplifiers, and recirculators. Techniques for shaping targets and wavefronts make possible new applications of laser power. These range from generations of plasmas simulating densities in any stellar body, very high isp rockets, cheap nuclear triggers, microwave, and x-ray and gamma-ray impulse generators. Reflective systems make possible the symmetrical illumination of very small targets. Superfinishing surfaces practically eliminates scattering losses. Gravitational force on stars can force their evolution through main sequence, white dwarf, neutron, and hyperon stages. The same physical conditions can probably be equalled, in volumes of submicron extent, by crushing a solid pellet in an optical bottle augmented by magnetic pumping due to target vorticity. This possibility in the context of special relativity suggests some new physical principles. (auth)

491 RELATIVISTIC ELECTRON-BEAM EXCITATION OF GAS LASERS. Gerardo, J. B.; Gerber, R. A.; Johnson, A. W.; Patterson, E. L. (Sandia Labs., Albuquerque, NM). Ann. N.Y. Acad. Sci.; 251: 590-608(8 May 1975).

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, NY (5 Mar 1974).

The experimental apparatus used to study the xenon vuv laser and the HF chemical laser is described. Also presented are some experimental results, including measurements of the net-gain cross section, the laser output spectrum, and the effect of diluent cooling. (MOW)

492 ELECTROIONIZATION LASERS OPERATING ON COMPRESSED CARBON DIOXIDE. Basov, N. G.; Belenov, E. M.; Danilychev, V. A.; Suchkov, A. F. (Lebedev Inst. of Physics, Moscow). Usp. Fiz. Nauk; 114: No. 2, 213-247(Oct 1974). (In Russian).

A survey of the theoretical and experimental results of investigations on electroionization gas lasers, the pressure of the working gas of which may reach tens of atmospheres, is presented. A study was made of the electroionization method of excitation which permits converting practically 100% of the electrical pumping energy into energy of molecule oscillations under optimal conditions. Experimental data are cited which show that the radiation power of the electroionization lasers is increased in proportion to the square of the gas pressure. Experimental data are cited on an investigation of the threshold and output characteristics, the efficiency and amplification factor of an electroionization CO_2 laser. Mention is made of the prospects of using laser devices operating on compressed carbon dioxide in the area of thermonuclear synthesis for selective stimulation of chemical reactions for application in the processing industry. The various operating modes of electroionization CO_2 amplifiers and generators are characterized. The brief characteristics are cited for a series of powerful laser devices. A description is given of the prospects of using the electroionization method for excitation both of the oscillational-rotational molecular levels (CO_2, CO, N_2O, NO, N_2, HF and others) and of the electron levels (N_2, H_2, CO, Cu, Pb, Xe_2 and others). Materials published prior to May 1973 are used in the survey. (Ref. Zh.)

493 LASER BASED ON SOLUTIONS OF ORGANIC COMPOUNDS PUMPED BY IFP-40000 FLASH LAMPS. Strizhnyeov, V. S. (Inst. of Physics, Minsk). Kvantovaya Elektron. (Moscow); 2: No. 1, 191-193(Jan 1975). (In Russian).

A high-power laser based on solutions of complex organic compounds and with output radiation energy of 27 J and 0.7% efficiency is reported. The solutions were pumped with IFP-40000 flash lamps. Oscillograms of the generation pulse and the pumping pulse showed that both have a smooth, peakless shape. The generation cutoff threshold is 2.5 times higher than the initial generation threshold. The duration of the emission pulse was 102 μsec. The angular and energy characteristics of stimulated emission were studied. It was noted that the homogeneity of the working solutions strongly affected the formation of the laser action. Photochronograms showed that generation begins 31 μsec after pumping. Eleven μsec before generation intensified luminescense is initiated, which then grows into generation and continues after its cessation up to the cutoff of pumping. (JPRS)

494 CHARACTERISTICS OF DIFFUSION LASER DIODES BASED ON InP AND InP_xAs_{1-x}. Ismailov, I.; Sadi'ev, A.; Altynba'ev, R.; Shokhudzha'ev, N. (Physico-Technical Inst., Dushanbe, USSR). Kvantovaya Elektron. (Moscow); No. 4, 814-819(1975). (In Russian).

The interest in InP semiconductor compounds and in solid solutions of InP_xAs_{1-x} is based on the possibility of their use for obtaining spontaneous and coherent radiation in a broad interval of wavelengths from 900 to 3000 nm. The principal parameters of injection InP and InP_xAs_{1-x} laser diodes are given for the purpose of their practical application. A description of the method of preparing these laser diodes is outlined along with a description of the method of obtaining the spectral and threshold characteristics of the diodes, the initial crystals for which were doped with donor material (Se and Te). The characteristics were measured at 4.2 and 77° K for constant and pulse currents. A table is given of the spontaneous and coherent radiation of these diodes for various values of x at these two temperatures. The parameters of the lasers are very close to those of diffusion laser diodes based on GaAs. (JPRS)

495 EFFECT OF REFLECTED SIGNALS ON STABILITY OF CARBON DIOXIDE LASER FREQUENCY AND POWER. Domanov, M. S.; Shcherbatykh, V. D. Kvantovaya Elektron. (Moscow); 2: No. 1, 99-104(22 Jan 1974). (In Russian)

The effect of reflected signals on the frequency stability of single-mode carbon dioxide lasers at high reflection coefficients was determined. The dependence of the frequency shift on the distance to the reflecting surface was found, along with a quantitative comparison of calculation and experimental data from investigating a one-frequency CO_2 laser. It was shown that when the reflections are weak (<0.1), the dependence of the drift of laser emission frequency and power on variations in the distance to the reflecting object is sinusoidal. The maximum frequency drifts were found to be proportional to the coefficient of reflection from the external object. When reflections are strong (>0.1) the frequency dependence becomes hysteresic in form. The system has several resonance frequencies, while the reflecting object is kept in the same position. Power modulation at the frequency discontinuity from one frequency curve branch to the other may be as high as 100%. The number of resonance frequencies depends on the distance to the reflecting object. It is recommended that special steps be taken to suppress the output radiation reflections so as to achieve required laser performance in systems employing lasers at high frequency and high power stability levels. (JPRS)

496 DYE PUMPING SYSTEM WITH U-SHAPED LAMP AND RECTANGULAR CROSS SECTION ACTIVE ELEMENT. Aniki'ev, Yu. G.; Vdovchenko, R. G.; Telepin, S. N. Kvantovaya Elektron. (Moscow); 2: No. 1, 7-12(Jan 1975). (In Russian).

Spectral-energy characteristics of pulsed lamps with high flash energies and high efficiency of the dye pumping optical system incorporating U-shaped and zigzag-shaped lamps and a rectangular cross section cell are reported. Use of the U-shaped and zigzag-shaped lamps in the pumping system (using rhodamine 6G dye) resulted in the most compact arrangement with the active element immersed in the immersion medium. Bulb lamps from standard LFP-25000 sources were used in the lamps. The radiative characteristics of the lamps (energy illumination, efficiency in corresponding spectral range, and uniformity of charge filling of channel) were studied, along with the duration of the light flash in different spectral intervals. Illuminator efficiency was determined by the expansion of the volume of active liquid. For an illuminator efficiency of about 0.2 and a lamp efficiency in the rhodamine pumping region approximating 16%, the stimulated energy emission of 50 J was attained with a 0.3% efficiency and a pumping pulse width of about 20 μsec. (JPRS)

497 INVESTIGATION OF CONTINUOUS EMISSION OF A CaF_2-Dy^{2+} LASER WITH HEMISPHERICAL CAVITY. Isayev, S. K.; Korniyenko, L. S.; Lariontsev, E. G. Vestn. Mosk. Univ., Ser. III. Fiz. Astron.; 15: No. 6, 752-754(1974). (In Russian).

A detailed study is undertaken on the way that emission kinetics is related to cavity parameters and mode composition of emission from a dysprosium cw laser. The research shows that the kinetics of continuous emission of a dysprosium laser depends appreciably on the parameters of the cavity. Undamped pulsations of emission in all investigated conditions are apparently determined by instabilities of the laser parameters. One of the principal results is the realization of nearly smooth practically single-frequency emission when the TEM_{00} mode is stimulated with admixture of weak transverse modes of low orders. This means that by using external selectors and lens systems one can create a practically single-frequency laser on CaF_2-Dy^{2+} with small angular divergence. Such a laser may be used as a master oscillator in producing powerful cw monochromatic emission with a wavelength of 2.36 μm. (Ref. Zh.)

498 LASER BEAM CONTROL APPARATUS. van den Berg, M. (to European Atomic Energy Community). US Patent 3,902,142. 26 Aug 1975. Priority date 18 Feb 1971, Luxembourg. 4p.

A control device for a laser beam, comprising a wheel which is driven at constant speed and has smooth sheet metal blades is described. The blades have a surface orientation perpendicular to the circumferential orientation and are supported for pivoting about an axis which is disposed in the surface of the wheel and extends through the wheel axis. A casing surrounds the bladed wheel and has an inlet and an outlet for a laser beam at positions at which the line connecting the two apertures perpendicularly intersects the pivoting axis in the zone of the blades. (auth)

499 RADIAL FLOW GAS DYNAMIC LASER. Damm, F. C. (to Secretary of the Air Force). US Patent 3,908,175. 23 Sep 1975. Filed date 30 May 1974. 8p.

The unique gas dynamic laser provides outward radial supersonic flow from a toroidal shaped stacked array of a plurality of nozzles, through a diffuser having ring shaped and/or linear shaped vanes, and through a cavity which is cylindrical and concentric with the stacked array, with the resultant laser beam passing through the housing parallel to the central axis of the diffuser which is coincident with the axis of the gas dynamic laser. Therefore, greater beam extraction flexibility is attainable, because of fewer flow shock disturbances, as compared to the conventional unidirectional flow gas dynamic laser in which unidirectional supersonic flow sweeps through a rectangular cavity and is exhausted through a two-dimensional diffuser. (auth)

500 LASER OSCILLATOR WITH A WAVELENGTH STABILIZING DEVICE. Terada, T.; Yamaguchi, I. (to Canon Kabushiki Kaisha). US Patent 3,902,135. 26 Aug 1975. Filed date 25 Feb 1974. 6p.

The laser tube constantly maintains a desired uniform wavelength of the laser beam. At least one of the two mirror members of the laser tube is movable, and is coupled magnetically with an electromagnetic stabilizing mechanism. The magnetic power of the electromagnetic mechanism is adjustable so that the distance between the two mirror members can be maintained constant irrespective of temperature changes and the like. As a result, a laser beam having a constant desired uniform wavelength is obtained. (auth)

501 ROTATING BLADEROW AERODYNAMIC WINDOW FOR HIGH POWER PULSED GASEOUS LASERS. Finkleman, D.; Weber, R. F. (to Secretary of the Air Force). US Patent 3,902,136. 26 Aug 1975. Filed date 30 May 1974. 4p.

An aerodynamic window for high power gaseous lasers having a plurality of blades mounted on the periphery of a circular disc outside the aperture in the laser cavity is described. The downwash of the blades as they move before said aperture provide a component directed into the cavity and away from the aperture to inhibit escape of the lasing medium. (auth)

502 ELECTRO-OPTIC DIFFRACTION GRATING TUNED LASER. Hughes, R. S. (to Secretary of the Navy). US Patent 3,902,137. 26 Aug 1975. Filed date 29 Oct 1974. 4p.

An electro-optic diffraction grating tuned laser comprising a laser medium, output mirror, retro-reflective grating and an electro-optic diffraction grating beam deflector positioned between the laser medium and the reflective diffraction grating is described. An optional angle multiplier may be used between the electro-optic diffraction grating and the reflective grating. (auth)

503 EFFECT OF GAS-DISCHARGE PLASMA OSCILLATIONS ON THE WIDTH OF THE INTERMODE BEATS OF AN He–Ne LASER. Korolev, F. A.; Korolenko, P. V.; Odintsov, A. I.; Spazhakin, V. A. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 19: No. 12, 151(Dec 1974).

Translated from Radiotekh. Elekron.; 19: No. 12, 2648(Dec 1974).

Plasma oscillations in a dc excited gas laser can lead to considerable fluctions in the parameters of the active medium. Results of a study of the action of gas-discharge plasma perturbations on the width of the beats of the longitudinal modes of a He – Ne laser with a wavelength of 6328Å are reported. (TFD)

504 CO_2 MHD LASER: ANALYSIS, DESIGN, AND SHOCK TUNNEL EXPERIMENTS. Zauderer, B.; Tate, E.; Marston, C. H. (General Electric Co., King of Prussia, PA). pp VII.8.1-VII.8.5 of Fourteenth Symposium on Engineering Aspects of Magnetohydrodynamics. Tullahoma, TN; Univ. of Tennessee Space Inst. (1974).

From 14th symposium on engineering aspects of magnetohydrodynamics; Tullahoma, TN (8 Apr 1974).

MHD laser gain exceeding 0.2 percent/cm has been achieved in the GE/ONR shock tunnel using a mixture of 78 percent helium, 18 percent argon and 4 percent CO_2 with either 1 percent Xe or 0.1 percent Cs added to the basic mixture for seeding. Long relaxation times and non-emitting electrodes required use of some external voltage augmentation to achieve the necessary plasma conditions in the available generator length. The MHD laser analysis, design of a channel based on that analysis, and experimental results are discussed. (Elect. Electron. Abstr.)

505 ELECTROMAGNETIC THEORY OF DISTRIBUTED FEEDBACK LASERS IN PERIODIC DIELECTRIC WAVEGUIDES. Evans, G. A. Pasadena, CA; California Inst. of Tech. (1975). 181p. University Microfilms Order No. 75-9523.

Thesis (Ph. D.).

A theory for distributed feedback lasers in transversely bound structures is developed. The space harmonics approach is used to discuss the general properties of periodic structures. The coupled mode approach is used to develop expressions for the threshold gain, longitudinal mode structure, and electromagnetic field

distribution for distributed feedback lasers. Three basic structures are considered for distributed feedback lasers—thin film waveguides, diffusion waveguides, and fiber waveguides. Equations for the amplification of a waveguide mode that extends transversely over both regions with and without gain are derived. Analytical expressions are derived for coupling between modes in periodically perturbed dielectric waveguides. Sinusoidal perturbations of the electric permittivity and of the waveguide boundary are considered. Theoretical results indicate that an optimum design of distributed feedback lasers can be achieved by an appropriate choice of geometrical parameters. Regions of optimum design are illustrated in numerous plots of normalized threshold gain versus normalized laser frequency. (Diss. Abstr. Int., B)

506 CONTINUOUS, TUNABLE SOURCE OF COHERENT, ULTRAVIOLET RADIATION. Gabel, C. W. Rochester, NY; Univ. of Rochester (1975). 258p. University Microfilms Order No. 75-15,200.

Thesis (Ph.D.).

The development and operation of a continuous, tunable source of coherent, ultraviolet radiation is described. A nonlinear crystal is used to frequency double the intracavity beam of a continuous-wave, rhodamine 6G organic dye laser. The source can be tuned over the spectral range of 282 to 320 nm and produces several milliwatts of uv output power near the center of the tuning range with a bandwidth of 0.025 nm. The bandwidth can be narrowed to less than 10^{-4} nm with an accompanying drop in uv output power to several hundred microwatts. (TFD)

507 GAS DYNAMIC LASERS. Hill, R. J.; Jewell, N. T. (to Rolls-Royce Ltd.). US Patent 3,899,749. 12 Aug 1975. Priority date 20 Jul 1971, United Kingdom of Great Britain and Northern Ireland. 10p.

In a high powered laser system it is proposed that combustion gases be bled off from a gas turbine engine and their composition adjusted by burning extra fuel in the bleed gases or adding extra substances. Suitable aerodynamic expansion produces a population inversion resulting in laser action in the CO_2 species. Alternatively, bleed gases may be taken from the high pressure compressor of the gas turbine engine and an appropriate fuel burned therein. If required, other adjustments may also be made to the composition and the resulting gaseous mixture subjected to aerodynamic expansion to induce laser action as before. (auth)

508 LASERS OPTICALLY PUMPED BY LASER-PRODUCED PLASMA. Silfvast, W. T.; Wood, O. R. II. (to Bell Telephone Labs., Inc.). US Patent 3,900,803. 19 Aug 1975. Filed date 24 Apr 1974. 10p.

Laser solids, liquids and gases are pumped by a new technique in which the output from an efficient molecular laser, such as a CO_2 laser, ionizes a medium, such as xenon, into a generally cylindrical plasma volume, in proximity to the pumped laser body. Breakdown yields a visible and ultraviolet-radiation-emitting plasma in that volume to pump the laser body. The spectral radiance of the plasma is significantly higher than that produced by a dc-discharge-heated plasma at nearly all wavelengths in the plasma spectrum. The risetime of radiation from the laser-produced plasma can also be significantly shorter than that of a dc heated plasma. A further advantage resides in the fact that in some applications the attenuating walls needed by flashlamps may be eliminated with the result that laser threshold is more readily reached. Traveling wave excitation may be provided by oblique incidence of the pumping laser beam through the ionizable medium to create sequential ionization of portions of that medium along the length of the pumped laser body. (auth)

509 MULTITUBE COAXIAL CLOSED CYCLE GAS LASER SYSTEM. Davis, J. W.; Walch, A. P. (to United Aircraft Corp.). US Patent 3,900,804. 19 Aug 1975. Filed date 26 Dec 1973. 8p.

A gas laser design capable of long term reliable operation in a commercial environment is disclosed. Various construction details which insulate the laser optics from mechanical distortions and vibrations inevitably present in the environment are developed. Also, a versatile optical cavity made up of modular units which render the basic laser configuration adaptable to alternate designs with different output capabilities is shown in detail. The system built around a convection laser operated in a closed cycle and the working medium is a gas which is excited by direct current electric discharges. (auth)

510 DYE LASER FOR HOLOGRAPHIC APPLICATIONS. Shajenko, P. (to Secretary of the Navy). US Patent 3,903,483. 2 Sep 1975. Filed date 7 Jan 1974. 8p.

A dye laser for holographic applications is described wherein a Q-switched ruby laser is used to pump the dye laser using Rhodamine-6G as the dye. The dye laser is pumped with a Q-switched ruby laser having its 6943 A output beam frequency-doubled with a KDP crystal. The light beam of 3472 A so obtained is applied to pump the dye laser in a longitudinal arrangement using a dispersing prism. The resultant tunable dye laser output is then applied for recording holograms. Multi-stage systems and cascade spectrum narrowing of the dye laser output are used to increase the overall efficiency for holographic applications. (auth)

511 LONG LIFE MOLECULAR GAS LASER. Hochuli, U. E. US Patent 3,899,751. 12 Aug 1975. Filed date 3 Dec 1973. 4p.

A cold cathode molecular gas laser in which the molecular dissociation at the cathode surface leading to gas depletion through formation of scaling layers and successive sputtering is counteracted by the choice of a cathode material whose scaling layers can be reduced in an atmosphere that is still compatible with laser action is described. Furthermore, among the cathode materials selected the ones that form or are doped to form semiconducting scaling layers can support higher cathode current densities at lower sputtering rates than the ones that form insulating layers of scale. The selection of cathode materials from the first groups of the periodic table leads to a minimum of negative ions in the sputtering products. Deposits stay confined near the cathode and do no harm to laser windows and mirrors. As an example, sealed-off CO_2 lasers that have lifetimes in excess of 10,000 h with cold cathodes selected according to these principles have been constructed. (auth)

512 LONG LIFE GAS LASER SYSTEM AND METHOD. Hochuli, E. E. US Patent 3,889,750. 12 Aug 1975. Filed date 21 Sep 1973. 2p.

A long life gas discharge laser having an improved self-repairing cathode system is described. In a specific embodiment, water vapor having a partial pressure below about 10^{-5} torr incorporated in a molecular sieve is used to provide impurities (in this case water vapor) for repairing the cathode surface by regenerating the oxide surface and/or preventing same from deteriorating. Other impurities may be incorporated in the molecular sieve such as hydrogen, oxygen, for example. In some cases CO_2 may be used. This application includes material disclosed in a paper entitled "Continuation of the Investigation into Material Properties Affecting the Frequency Stability and Reliability of He-Ne Laser Structures" submitted to the Office of Naval Research dated June 1972 by the inventor hereof and also a paper entitled "Investigations of the Long Term Frequency Stability of Stable Laser Structures" Progress Report for ONR Contract N00014-67-A-D239-0016 July 1972 by the inventor hereof. A royalty free license is hereby granted to the United States for use of the invention for all government purposes. (auth)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 1433, 1457, 2051, and 2247.

513 (AD/A-003555) COMMENT ON "OBSERVATIONS OF THERMAL FLUCTUATIONS IN SUPERCONDUCTING MICROBRIDGES". Webb, W. W.; Lukens, J. E. (Cornell Univ., Ithaca, N. Y. (USA). School of Applied and Engineering Physics). 1 Jan 1975. Contract N00014-67-A-0077-0016. 9p. NTIS $3.25.

The interesting switching phenomena recently reported by Rachford et al. to occur at the onset of certain puzzling current and temperature dependent steps in superconducting microbridges should be considered a phenomenon yet to be explained rather than a case to which existing theory of thermally activated phase slips is directly applicable. (GRA)

514 (AD/A-004267) SUPERCONDUCTING-CAVITY STABILIZED OSCILLATORS OF 6×10^{-16} STABILITY. Journal Article 72-74. Stein, S. R.; Turneaure, J. P. (Stanford Univ., Calif. (USA). High-Energy Physics Lab.). Dec 1974. Contract N00014-67-A-0112-0076. 8p. (HEPL-746). NTIS $3.25.

X-band microwave oscillators stabilized with superconducting niobium cavities with loaded Q's of about 10^{10} achieved short-term frequency stabilities as low as $(\sigma_y) = 6 \times 10^{-16}$ and typical long-term fractional frequency drifts of $\pm 2 \times 10^{-13}$ per day. (GRA)

515 (AED-CONF-75-170-008) USE OF THE HARD SUPERCONDUCTOR Nb_3Sn IN MICROWAVE RESONATORS. Hillenbrand, B.; Martens, H.; Schnitzke, K. (Siemens A. G., Erlangen (F. R. Germany). Forschungslaboratorium). 1975. 9p. (In German). INIS.

From general meeting of the Deutsche Gesselschaft fuer Metallkund e.V.; Nuernberg, F. R. Germany (20 May 1975).

The use of superconductors in microwave resonators leads to a decrease in the wall loss by four to five powers of ten. Whereas the alternating field losses above B_{c1} increase strongly with technical frequencies, this does not apply to the microwave

region. Compared to the usual niobium which is used at T < 2 K, hard superconductors with high T_c such as Nb_3Sn offer the chance of greater field strengths and higher permissible working temperatures. Measurements on superconducting cavity resonators are reported on Nb_3Sn surfaces. At 4.2 K, the quality was up to 50 times better than with the corresponding Nb resonators. (auth)

516 (BNL-20443) ADVANCED REFRIGERATION SYSTEM FOR THE BROOKHAVEN SUPERCONDUCTING CABLE PROJECT. Jensen, J. E. (Brookhaven National Lab., Upton, N.Y. (USA)). 1975. 42p. (CONF-750956-1). Dep. NTIS $5.25.

From symposium on advanced refrigeration systems; Moscow, USSR (Sep 1975).

A description is given of a basic supercritical refrigerator. The present status of the cable enclosure and the types of cooling schemes being considered are presented with some examples of laboratory results and computer analysis. (MOW)

517 (BNL-20444) BROOKHAVEN PROGRAM TO DEVELOP A HELIUM-COOLED POWER TRANSMISSION SYSTEM. Forsyth, E. B. (Brookhaven National Lab., Upton, N.Y. (USA)). 1975. 45p. (CONF-750950-1). Dep. NTIS $5.25.

From conference on technical applications of superconductivity; Alushta, USSR (16 Sep 1975).

The particular system under design consists of flexible cables installed in a cryogenic enclosure at room temperature and cooled to the range 6 to 9°K by supercritical helium, contraction of the cable is accommodated by proper choice of helix angles of the components of the cable. The superconductor is Nb_3Sn and at the present time the dielectric insulation is still the subject of intensive development. Two good choices appear to be forms of polyethylene and polycarbonate. Sample cables incorporating various dielectrics have been manufactured commercially in lengths of 1500 ft and tested in laboratory cryostats in shorter sections of about 70 ft. A test facility is under construction to evaluate cables and cryogenic components for this type of service, the first refrigerator uses a 350 H.P. screw compressor and three turbo-expander stages. It is hoped to achieve reliability of a very high order. The first three-phase tests will be conducted at 69 kV, although it appears that 230 to 345 kV is the most likely voltage range for future applications. (auth)

518 (CEA-CONF-3065) PREDICTION OF MAXIMUM QUENCHING CURRENTS IN COILS MADE OF HIGH CURRENT MULTIFILAMENTARY COMPOSITES OR MULTISTRAND CABLES. Duchateau, J. L.; Turck, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. du Synchrotron Saturne). 21 Apr 1975. 5p. (CONF-750438-8). Dep. NTIS (US Sales Only) $4.00.

From 5th international conference on magnet technology; Frascati, Italy (21 Apr 1975).

For superconducting magnets of high current composites, the maximum performance is often limited by the so-called degradation. One fundamental reason arises from the fact that if transposition of the filaments in a composite allows complete sharing of the transport current, twisting does not. As a result, the filaments behave collectively, and the overall self field can give rise to a catastrophic flux jump. The stability of multifilamentary composites is examined with respect to possible composites and current levels. Expressions and curves are useful for determining quenching currents in coils under various cooling. (auth)

519 EFFECT OF THE QUASIPARTICLE-PAIR INTERFERENCE CURRENT ON THE THERMAL FLUCTUATIONS IN WEAKLY COUPLED SUPERCONDUCTORS AND ON THE OPERATION OF rf-BIASED SQUIDS. Falco, C. M. Irvine, CA; Univ. of California (1974). 203p. University Microfilms Order No. 75-11,027.

Thesis (Ph. D.).

Careful studies of the effect of thermal fluctuations on the I-V characteristics of two different types of weakly coupled superconductors were made. Measurements on externally shunted, oxide-barrier tunnel junctions were found to be in complete quantitative agreement with a theory due to Ambegaokar and Halperin in the limit of beta/sub c/ identical with 2eI/sub c/C/ sigma$\frac{3}{2}$ h much less than 1 where the theory is valid. Similar measurements in the region of beta/sub c/ approximately equal to 1 were found to be in qualitative agreement with a theory due to Kurkijarvi and Ambegaokar. Assuming the Ambegaokar and Halperin theory is applicable, measurements on Notarys-Nercereau normal metal underlay weak links indicate the presence of a phase-dependent conductivity predicted by B. D. Josephson in 1962. The magnitude of this conductivity was found to be in agreement with that predicted by theory, however, the sign of the conductivity was found to be in disagreement. A study of the operating characteristics of rf-biased thin-film superconducting quantum interference devices (SQUIDs) has also been made and a set of performance parameters developed to optimize the behavior of these devices. The behavior of these SQUIDs has been compared with a theory due to Hansma in order to look for the effect of the phase-dependent quasiparticle-pair interference current. The measurements were found to be qualitatively different than predicted by Hansma's theory. (Diss. Abstr. Int., B)

520 SUPERCONDUCTING-CAVITY STABILIZED OSCILLATOR AND AN EXPERIMENT TO DETECT TIME VARIATION OF THE FUNDAMENTAL CONSTANTS. Stein, S. R. Stanford, CA; Stanford Univ. (1974). 111p. University Microfilms Order No. 75-6932.

Thesis (Ph. D.).

A precision microwave oscillator system has been developed which has a superconducting cavity as its frequency determining element. The frequency stability of this device, called the superconducting-cavity stabilized oscillator (SCSO), has been studied using both spectrum analysis and period measurement techniques. For times shorter than one-thousand seconds the frequency fluctuations, as measured by the Allan variance, are smaller than for any other high stability frequency source; the noise floor of the fractional frequency fluctuations is 6×10^{-16} at the present time. The long term performance of an ensemble of SCSO systems has been measured relative to the frequency of a cesium-beam frequency standard. Theory is presented which relates an SCSO–Cs frequency drift to time variation of the fine structure constant. Since various SCSO systems have both positive and negative drift relative to the frequency of cesium with a magnitude of about 2×10^{-13} day^{-1}, it is concluded that (1/alpha) parallel d alpha/dt parallel is less than 3×10^{-11} year^{-1}. This is the first significant upper limit set on the time variation of the fine structure constant by a laboratory experiment. (Diss. Abstr. Int., B)

521 OBSERVATION OF MICROWAVE JOSEPHSON RADIATION IN THIN-FILM SUPERCONDUCTING BRIDGES. Gubanov, V.N.; Koshelets, V.P.; Ovsyannikov, G.A. JETP Lett. 21: No. 8, 226-227 (20 Apr 1975).

We report direct observation of microwave Josephson radiation in thin-film superconducting bridges. (auth)

522 GRANULAR ALUMINUM SQUID's. Deutscher, G.; Rosenbaum, R. (Tel-Aviv University, Department of Physics and Astronomy, Ramat-Aviv, Israel). Appl. Phys. Lett. 27: No. 6, 366-368 (15 Sept 1975).

Granular aluminum thin films have been used to produce rf-pumped SQUID's. Owing to the low critical current density of the granular superconductors, SQUID's with weak links as wide as 40 μm are observed to operate even far below T_c. (auth)

523 PARAMETRIC AMPLIFICATION BY UNBIASED JOSEPHSON JUNCTIONS. Feldman, M.J.; Parrish, P.T.; Chiao, R.Y. (Department of Physics, University of California, Berkeley, California 94720). J. Appl. Phys. 46: No. 9, 4031-4042 (Sept 1975).

The theory of parametric amplification by a series of unbiased Josephson junctions is presented. The various regimes of operation are explored. This device is in many ways different from the usual varactor parametric amplifier. In particular, a very small pump power is required and a large bandwidth is obtained. Comparison with experimental data is made. (auth)

524 TWO-IDLER PARAMETRIC AMPLIFICATION WITH JOSEPHSON JUNCTIONS. Kanter, H. (Electronics Research Laboratory, The Aerospace Corporation, Los Angeles, California 90009). J. Appl. Phys. 46: No. 9, 4018-4025 (Sept 1975).

A self-pumped Josephson junction can be operated in a mode which is described in first order by a two-idler parametric amplifier analysis for a sinusoidal elastance variation. Thus the analysis and operation follows the two-idler negative resistance behavior predicted by Penfield and Rafuse for varactor diodes. Experimental observations on parametric negative conductance excitations at 9 GHz by a Josephson point contact are readily explained by the two-idler model. A total signal power gain of 12 dB was achieved with an experimental device consisting of a niobium titanium point contact in a shallow rectangular cavity coupled through a room-temperature circulator. (auth)

525 MULTILAYER SUPERCONDUCTING SHIELD. Bondarenko, S.I.; Sheremet, V.I.; Vinogradov, S.S.; Ryabovol, V.V. (Physicotechnical Institute of Low Temperatures, Academy of Sciences of the Ukrainian SSR, Khar'kov). Sov. Phys.—Tech. Phys. 20: No. 1, 73-76 (July 1975).

Using controlled propagation of the superconducting state into three coaxial simply-connected lead shells, a magnetic "void" of $3 \cdot 10^{-9}$ Oe is obtained in a volume of 400 cm^3. (auth)

526 SIMPLE METHOD FOR JOSEPHSON CRITICAL CURRENT CONTROL OF SOLDER DROP JUNCTIONS. Iguchi, I.; Hara, K. (Department of Mathematical Engineering and Instrumentation

Physics, University of Tokyo, Tokyo, Japan). Rev. Sci. Instrum. 46: No. 10, 1423-1424 (Oct 1975).

A simple method, which controls the Josephson critical current of a solder drop junction smoothly and quickly with the junction immersed in liquid helium, is presented. (auth)

527 CONSIDERATION ON THE SUPERCONDUCTING COIL FOR ENERGY STORAGE. Kaiho, K. (Electrotechnical Lab., Tokyo). Denki Shikensho Iho; 37: No. 12, 1091-1100(1973).

Optimum shapes of the superconducting coils for energy storage were studied. Taking account of large inductances and small leakage magnetic fields, toroidal coils with various cross sectional shapes (rectangles, triangles, circles, half circles and semicircles) are selected and compared. In designing the coil shapes, conditions to make the necessary wire length minimum and the energy density maximum are discussed. Consequently the semicircular cross section has been found to be the most favourable for the condition of the minimum wire length, and the rectangular cross section for the maximum energy density. (Elect. Electron. Abstr.)

528 SUPERCONDUCTING DEVICE. Kugler, S.; Clarke, M. E. (To British Oxygen Co., Ltd.). British Patent 1395707/B/. 29 May 1975. Filed Date 25 May 1971. 3p.

In order to make use of superconducting properties of a metallic winding it is necessary to cool the winding to about 4.2°K with liquid He or cold gaseous He. When the winding is not required to be superconducting the He is removed so as to reduce evaporation losses. This, however, allows the winding to return to ambient temperature, and in order to resume superconducting working, both wasteful use of reintroduced He and a time delay are involved. In the device described a "heat pipe" is provided in thermal contact with a part of the device adjacent to the winding and with a cooling system. The working fluid in this "heat pipe" has a triple point above 4.5°K and below the working temperature of the cooling system. A particular application is for superconducting magnets. By the term "heat pipe" is meant a closed elongated shell containing a volatile fluid and a wick that is able by capillary action to transfer liquid from end to end of the shell. In order to achieve superconducting conditions He is added to the chamber in which the winding is located. When the He is present the working fluid in the heat pipe freezes and very little heat is transmitted along the pipe. When the device is not being operated under superconducting conditions, however, the He is removed and the winding is maintained at the temperature of the cooling system by transmission of heat along the heat pipe. The choice of fluid for the heat pipe depends on the temperature of the cooling system; suitable fluids include liquid N_2, Ar, Ne, and H_2, but liquid H_2 is usually preferred. The arrangement gives the advantage of automatic maintenance of the device at reduced temperature when not in use. A mechanical refrigerator may also be included in the cooling system. (UK)

529 THIN-FILM dc SQUID WITH LOW NOISE AND DRIFT. Clarke, J.; Goubau, W. M.; Ketchen, M. B. (Univ. of California, Berkeley). Appl. Phys. Lett.; 27: No. 3, 155-156(1 Aug 1975).

The fabrication and operation of thin-film dc SQUID's of cylindrical geometry that make use of shunted Nb-NbO/sub x/-Pb tunnel junctions are described. A typical noise power spectrum is shown. At frequencies between 2 x 10^{-2} Hz and the electronic roll-off frequency, the flux resolution is 3.5 x 10^{-5} phi/sub 0// (Hz)/sup ½/, corresponding to a magnetic field resolution of 10^{-10} G/(Hz)/sup ½/. This resolution appears to be set by intrinsic sensor noise. Below 2 x 10^{2} Hz, the spectrum is approximately 1/f. A 20-h plot of SQUID output as a function of time demonstrates an average drift of less than 2 x 10^{-5} phi/sub 0//h. (auth)

530 METHOD OF PRODUCTION OF SUPERCONDUCTING RIBBON CABLE. Sumarokov, V. N. USSR Patent 410,505. 12 May 1974. Filed date 1 Nov 1971. vp. (In Russian).

A method is proposed for production of superconducting ribbon cable which includes deposition of the components of an intermetallic compound on a moving belt-substrate by their evaporation and condensation in a vacuum. Before deposition of components of the superconducting intermetallic compound, a system of continuous longitudinal grooves is formed on the surface of the belt-substrate, and during deposition of the components of the intermetallic superconducting compound, the ribbon is oriented obliquely to the direction of flow of the vapors. (Ref. Zh.)

531 MILLIMETER AND SUBMILLIMETER RECEIVERS USING JOSEPHSON JUNCTIONS. Nad, F. Ya. (Inst. of Radiomechanics and Electronics, Moscow). Instrum. Exp. Tech.; 18: No. 1, 1-15(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 7-22(1975).

The principle of operation of millimeter and submillimeter receivers using Josephson junctions is described; different constructions of these receivers are described, and their parameters are given. The drawbacks of the existing receivers are noted, and the prospects of further improvement in their construction and increase of sensitivity are discussed. (100 references) (auth)

532 RANDOM ERRORS IN THE MAGNETIC FIELD OF SUPERCONDUCTING DIPOLES AND QUADRUPOLES. Parzen, G. (Brookhaven National Lab., Upton, NY). Part. Accel.; 6: No. 4, 237-243(1975).

Random errors in the magnetic field of superconducting magnets are likely to be larger than those found in conventional warm magnets. The random error multipoles introduced by random errors in the position of the current blocks are computed for cosine dipoles and quadrupoles and for window-frame dipoles. Analytical results are compared with computed results, and the computed results are compared with the results of measurements made on models of the cosine and window-frame magnets. (auth)

533 I. EQUILIBRIUM AND NON-EQUILIBRIUM SUPERCONDUCTING QUANTUM INTERFERENCE PHENOMENA. II. APPLICATIONS OF SUPERCONDUCTING QUANTUM MAGNETOMETER. Wang, R. H. Pasadena, CA; California Inst. of Tech. (1975). 135p. University Microfilms Order No. 75-9543.

Thesis (Ph. D.).

Experimental investigations were made on the equilibrium and nonequilibrium quantum interference phenomena in superconductors. A new instrument was developed for measuring magnetic susceptibility and moment with an improvement of sensitivity of nearly two orders of magnitude over the conventional magnetometers. A quantitative determination was made on the relaxation rate of a perturbed superconducting phase to relax back to its equilibrium state. The temperature-dependent relaxation time is found to be consistent with the known quasiparticle relaxation time in nonequilibrium superconductors. The effect of relaxation processes on macroscopic quantum interference phenomena was observed for the first time through the temperature modulation of quantum interference in multiply connected superconducting circuits, and implies a modification of the Josephson frequency-voltage relationship. A relaxation model was developed and found adequate to account for nearly all the experimental results. The development and performance of an ultrasensitive superconducting magnetometer instrument based on various unique properties of superconductors were discussed. Applications of this instrument over a temperature range of 200°K in the fields of magnetochemistry, palemagnetism and the study of fluctuation effects in superconductivity were illustrated with actual data. (Diss. Abstr. Int., B)

Heat Transfer and Fluid Flow

Refer also to abstracts 2333, 2431, 2458, 2473, and 2501.

534 (BNWL-tr-155) HEAT TRANSFER TO FINNED TUBES AND COMPUTATION OF TUBE BANK HEAT EXCHANGERS. Schmidt, T. E. Translated from Kaeltetechnik; 15: No. 12, 370-378(1963). 26p. Dep. NTIS $5.00.

Data on the heat transfer characteristics and average heat transfer coefficients of heat exchangers containing finned tubes and tube bundles are correlated to derive the most simple relation possible to express the heat transfer coefficient as a function of both flow conditions and heat transfer surface configuration. (LCL)

535 (CLM-R-146) NUMERICAL SOLUTIONS OF DIRICHLET PROBLEMS WITH AXISYMMETRY BY AN INTEGRAL EQUATION METHOD. Fielding, P. J.; Bevir, M. K. (UKAEA Research Group, Abingdon. Culham Lab.). Mar 1975. 27p. Dep. NTIS (US Sales Only) $4.50. UK pounds 1.00.

Analytic solutions to problems in potential theory can be obtained for only a limited class of boundary geometries and for rather simple types of boundary condition. Finite difference methods allow a much wider class of problems to be solved numerically; however, the treatment of complicated boundary surfaces generally is cumbersome, requiring interpolation and extrapolation of boundary values to the peripheral mesh-points. In addition, the resulting computer programs are large and slow, particularly in the case of exterior problems. A more natural treatment of boundaries is obtained by reformulating such problems in terms of integral equations. One such reformulation is used here as the basis of a fast, accurate numerical method for solving three-dimensional axisymmetric Dirichlet problems. The method is particularly suited to applications where the gradient of potential at the boundaries is required. (auth)

536 (CONF-750804-10) TRANSIENT PROPAGATION BEHAVIOR OF TWO-PHASE FLOW EQUATIONS. Lyczkowski, R. W. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). 1975. 31p. Dep. NTIS $5.00.

From conference on heat transfer; San Francisco, California, USA (11 Aug 1975).

The capability of published two-phase flow equation sets to predict transient propagation behavior has been studied numerically. The equation sets are those cited by Wallis for separated flow and extensions of those used by Rudinger and Chang for dispersed flow. The primary difference between these two sets is that in the set cited by Wallis, the pressure gradient appearing in each momentum equation is weighted by the phase volume fraction, whereas in the extended Rudinger–Chang set, the pressure gradient appears only in the "continuous" phase. The original Rudinger–Chang set had to be modified because it can adequately describe only the transient flow of very dilute suspensions of solids in air. This numerical study shows that pressure pulses propagate at essentially the sound speeds obtained from characteristics analysis for the equation sets investigated. Comparisons of numerical results with experimental air-water pressure propagation data show that only the modified Rudinger–Chang equation set exhibits propagation behavior in good agreement with the experimental observations at low (less than 10 percent) void fractions. None of the equation sets adequately predict the experimental pressure propagation rates in the range of void fractions from 10 to 60 percent where the flow regime was observed to change from bubbly to full slug flow. The modified Rudinger–Chang set explains an apparent discontinuity in the experimental pressure wave propagation speed at a void fraction of 50 percent if the entire pressure gradient is assumed to be carried by the liquid for less than 50 percent voids and by the vapor for greater than 50 percent voids; however, the magnitude of the calculated discontinuity is greater than the experimental discontinuity. (auth)

537 (INIS-mf-1521, pp COLBI-COLB37) DETERMINATION OF HEAT TRANSFER COEFFICIENTS FOR SLURRIES IN A SPIRAL HEAT EXCHANGER. Colborn, R. P. (Atomic Energy Board, Pelindaba, South Africa). 1974.

From conference on heat transfer and the design and operation of heat exchangers; Johannesburg, South Africa (18 Apr 1974). (South African Inst. of Chemical Engineers, Johannesburg; South African Inst. of Mechanical Engineers, Johannesburg; Council for Scientific and Industrial Research, Pretoria (South Africa)).

The spiral heat exchanger can be used for the exchange of heat from one slurry to another. The rates of corrosion and erosion measured during the experiments conducted on a slurry made from typical Witwatersrand gold- and uranium-bearing ores are well within the permissible limits for industrial applications. A method for the determination of heat transfer coefficients for the slurries investigated is discussed. (INIS)

538 (INIS-mf-1521, pp JAWI-JAW37) LATENT-HEAT-BASED CORRELATION OF SATURATED POOL BOILING HEAT TRANSFER. Jawurek, H. H. (Atomic Energy Board, Pelindaba, South Africa). 1974.

From conference on heat transfer and the design and operation of heat exchangers; Johannesburg, South Africa (18 Apr 1974). (South African Inst. of Chemical Engineers, Johannesburg; South African Inst. of Mechanical Engineers, Johannesburg; Council for Scientific and Industrial Research, Pretoria (South Africa)).

A breakdown is given of the energy flows associated with an area of bubble influence. The primary surface-to-liquid heat transfer processes, although the ideal basis of correlation, are shown to be amenable to analysis only if severely simplifying assumptions are made. Examination of the "bulk convection" correlations illustrates this difficulty. An alternative approach is suggested. Its basis is the experimental finding that the energy initially transferred from surface to liquid is redistributed in the fluid phases so as to manifest itself almost entirely in vapor detachment ("latent heat transport"). The resulting model is analyzed without recourse to mechanistic assumptions. Coupled with a method of surface characterization (similar to that of Mikic and Rohsenow) this leads to a new and realistic heat transfer correlation. Comparisons with experimental data are presented. These indicate that the correlation allows the prediction of boiling curves q/A versus ΔT_{sat} at any pressure, provided that at least one boiling curve for the same surface, or preferably the same surface-liquid combination, is available as a reference. (INIS)

539 (INIS-mf-1521, pp LOUW1-LOUW24) PROFILE DISTORTION IN LIQUID METAL HEAT TRANSFER. Louw, R. A.; Buhr, H. O. (Cape Town Univ.). 1974.

From conference on heat transfer and the design and operation of heat exchangers; Johannesburg, South Africa (18 Apr 1974). (South African Inst. of Chemical Engineers, Johannesburg; South African Inst. of Mechanical Engineers, Johannesburg; Council for Scientific and Industrial Research, Pretoria (South Africa)).

Turbulent velocity and temperature profiles for mercury flowing vertically upwards in a round pipe under the condition of constant wall heat flux were measured. Readings were taken at Reynolds Numbers of 33,000 and 54,000 at various values of heat flux. Non-isothermal velocity profiles were all found to differ markedly from the normally accepted isothermal velocity profile, even at low heat fluxes. To ensure that the measured distortion was not due to entrance length effects, velocity and temperature profiles were measured for thermal lengths of 17, 36, 61, and 84 diameters. Profiles were found to be fully developed after 61 diameters. Correlations are presented whereby the amount of distortion of the non-isothermal velocity profile from the isothermal profile may be estimated and the value of the Nusselt Number under given conditions may be predicted. (INIS)

540 (UCRL-51894) NUMERICAL SOLUTION OF THE NAVIER–STOKES EQUATIONS AT HIGH REYNOLDS NUMBERS. Shestakov, A. I. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1974. Contract W-7405-eng-48. 98p. Dep. NTIS $5.45.

Thesis.

A numerical method is presented which is designed to solve the Navier-Stokes equations for two-dimensional, incompressible flow. The method is intended for use on problems with high Reynolds numbers for which calculations via finite difference methods have been unattainable or unreliable. The proposed scheme is a hybrid utilizing a time-splitting finite difference method in areas away from the boundaries. In areas neighboring the boundaries, the equations of motion are solved by the newly proposed vortex method by Chorin. The major accomplishment of the new scheme is that it contains a simple way for merging the two methods at the interface of the two subdomains. The proposed algorithm is designed for use on the time-dependent equations but can be used on steady state problems as well. The method is tested on the popular, time-independent, square cavity problem, an example of a separated flow with closed streamlines. Numerical results are presented for a Reynolds number of 10^3. (auth)

541 (UCRL-Trans-10949) MINIMUM SPECIFIC WETTING OF FLAT SURFACES. Hobler, T.; Czajka, J. Translated From Chem. Stosow., Ser. B; 5: No. 2B, 169-186(1966). 32p. Dep. NTIS $5.00.

Experimentally determined minimum specific wetting rates of plane surfaces made of various materials are presented. The wetting was increased starting from zero with an initially completely dry surface. The results are described by a correlating equation which contains the Reynolds number, the equivalent Weber number, and the angle of contact. (auth)

542 TRUE VOLUMETRIC STEAM CONTENTS AND STRUCTURES OF TWO-PHASE NONEQUILIBRIUM FLOWS IN NON-HEATED CHANNELS. Styrikovich, M. A.; Nevstrueva, E. I.; Tyutyaev, V. V. (Inst. of High Temperatures, Moscow). Therm. Eng.; 21: No. 9, 25-29(Sep 1974).

Translated from Teploenergetika; 21: No. 9, 18-22(Sep 1974).

Results of a study of the distribution of true volumetric steam contents and patterns of flow along a nonheated channel are presented. The channel was installed directly after a steam generating channel at a pressure of 30 kgf/cm^2 and with a mass velocity of 1000 kg/m^2-s. The load at the preceding steam generating section was 0.4, 0.6, and 0.8 MW/m^2. These results showed that: at negative values of relative enthalpy of the flow the flow pattern varies comparatively little, and over the outlet cross section of the channel a considerable amount of steam condensation is noted; at low negative values of relative enthalpy of the flow, less in absolute value than −0.002, enlargement of steam accumulations along the channel, especially prominent over a length up to 50d from the inlet, takes place; at low positive values of relative enthalpy of the flow (from 0 to about 0.02) enlargement of steam accumulations also takes place along the channel with formation of large slugs, separated by water, (at X = 0.01 to 0.02) which pass through the channel; at X > 0.02, at the outlet cross sections of the channel steam slugs with a surface covered by waves are observed; at X > 0.023 a slug flow regime is observed only over cross sections at a distance of 43d and 77d from the inlet; and the proposed method of recording variations with time and along the length of the channel in cross-section-average true volumetric steam contents is promising not only for estimating true volumetric steam contents but also for analysis of flow regimes and of the variations along the channel at different relative enthalpies of two-phase flows. (LCL)

543 VOID FRACTION MEASUREMENT IN TWO-PHASE TWO-COMPONENT FLOW BY CAPACITANCE METHOD. Del Tin, G.; Fiegna, G.; Grosso, G. (Istituto di Fisica Tecnica e Impianti Nucleari, Turin). Termotecnica (Milan), Suppl.; 29: No. 8, 2-11(Aug 1975). (In Italian)

The capacitance method is very useful for void fraction measurement both in steady and unsteady two-phase flow especially in complex geometry (such as rod bundles of fuel elements in

boiling water reactors). A previous calibration was made for a correct evaluation of the experimental data. Therefore, an adiabatic loop was built, where the quality of an air and water mixture is known and its void fraction measured by quick closing valves. The capacitance probe to be calibrated was inserted in the vertical channel of the loop, in which the mixture was flowing upward. The purposes of the present work were: to collect experimental data for drawing a calibration curve for a set of geometrically different probes; to compare the performances of various probes; and to study the effect of the flow pattern on the total impedance between geometrically different electrodes of the probes. (auth)

544 HEAT AND MASS TRANSFER BIBLIOGRAPHY. Soviet Works. Lulkov, A. V. (Inst. of Geochemistry, Minsk). Int. J. Heat Mass Transfer; 18: No. 7, 981-988(Jul 1975).

Approximately 300 references to books and journal articles on Soviet work on heat and mass transfer, published mainly over the period 1973 to 1974, are presented. References are arranged under several subject headings which include thermodynamics, thermophysical properties, heat conduction, hydromechanics, forced and natural convection, capillary-porous bodies, phase conversion, radiation, heat and mass transfer, and rheophysics. (UK)

545 HEAT TRANSFER BIBLIOGRAPHY. Eckert, E. R. G.; Sparrow, E. M.; Goldstein, R. J.; Scott, C. J.; Ibele, W. E. (Univ. of Minnesota, Minneapolis). Int. J. Heat Mass Transfer; 18: No. 7, 975-980(Jul 1975).

Approximately 300 citations are presented of books and journal articles on heat and mass transfer published during 1974. References are arranged under 16 subject headings. (UK)

Materials Testing

Refer also to abstract 2492.

546 (AED-CONF-75-179-001) ULTRASONIC TESTING OF THE PERFORATED REGION OF REACTOR PRESSURE VESSELS. Seiger, H. (Krautkraemer (Dr. J. u. H.) Gesellschaft fuer Elektrophysik, Cologne (F. R. Germany)). 1975. 4p. (In German). INIS.

From lecture meeting of the Deutsche Gesselschaft fuer Zerstoerungsfreie Pruefverfahren e.V.; Berlin, F. R. Germany (6 May 1975).

Reactor testing, nozzle fields, external testing, comparison between various methods to detect reflectors near the cladding from the unclad side are described. Scattering reflex ions from the austenitic cladding as failure indicators are discussed. (auth)

547 (AED-CONF-75-179-002) ULTRASONIC LOCATION OF DEFECTS IN NOZZLE WELDS OF PRESSURE VESSELS. Boogaard, J.; Janssen, G. J. 1975. 4p. (In German). INIS.

From lecture meeting of the Deutsche Gesellschaft fuer Zerstoerungsfreie Pruefverfahren e.V.; Berlin, F. R. Germany (6 May 1975).

An exact and reproducible method of ultrasonic testing of nozzle welds in cylindrical pressure vessels is presented. Calculation of the trajectory of sound in the walls of the vessel and determination of the position of the testing probe using a special apparatus are discussed. (auth)

548 (INIS-mf-1419) RADIOGRAPHIC INSPECTION OF CASTING. Smit, J. (South African Inst. of Foundrymen, Johannesburg; South African Association for Non-destructive Testing, Pretoria). 1972. 14p. (CONF-720748-1). INIS.

From symposium on physical processes responsible for dispersal of pollutants in the sea; Aarhus, Denmark (4 Jul 1972).

Industrial radiography is considered as an integral part of the manufacturing processes conducted in the foundry. The versatile properties of x- and gamma-rays, the remarkable developments in modern equipment and the flexibility of the techniques that can be employed are discussed. This radiographic inspection is generally used to determine the soundness of castings and is the most valuable tool to achieve quality controlled castings. (INIS)

549 ISOTOPE AND X-RAY RADIOGRAPHY. II. Applications. Becker, E. (Technische Hochschule, Magdeburg, Ger.). Isotopenpraxis; 11: No. 5, 165-171(May 1975). (In German).

The bibliographic review is completed with illustrations of the use of radiography in the examination of welded joints, cast and forged metals, non-metallic building and construction materials, reactor construction and operation, and miscellaneous applications. (151 references) (JSR)

550 APPARATUS FOR CARRYING OUT ULTRASONIC INSPECTION OF PRESSURE VESSELS. Dent, K. H.; Greenhalgh, F. G. (to United Kingdom Atomic Energy Authority). US Patent 3,901,073. 26 Aug 1975. Priority date 18 Dec 1972, United Kingdom of Great Britain and Northern Ireland. 4p.

An apparatus is described for moving an ultrasonic scanning mechanism over the interior surface of a pressure vessel and comprising a mast for supporting the scanning mechanism inside the vessel and a carriage for traversing the mast within the vessel, the mast being pivotably secured to the carriage so that when the ultrasonic scanning mechanism contacts the interior surface of the pressure vessel the mast is caused to pivot. (auth)

Nuclear Explosions

Refer also to abstracts 27, 611, and 810.

551 (AD/A-003484) COMPARISON OF THE LASA-NORSAR SHORT PERIOD ARRAYS. Chang, A. C. (Teledyne Geotech, Alexandria, Va. (USA). Seismic Data Lab.). 12 Apr 1974. Contract F08606-74-C-0006. 52p. (SDAC-TR-74-5). NTIS $4.25.

The study compares the LASA and NORSAR short-period arrays in terms of their detection processing systems and their event summaries for data recorded during a period of 40 days from 15 February to 25 March 1972. An overview of the worldwide surveillance performance of the combined LASA-NORSAR systems is also given. (GRA)

552 (AD/A-003507) VELA NETWORK EVALUATION AND AUTOMATIC PROCESSING RESEARCH. Quarterly Report No. 3, 1 May–31 July 1974. Harley, T. W. (Texas Instruments, Inc., Dallas (USA)). 15 Aug 1974. Contract F08606-74-C-0033. 17p. (TI-ALEX-(01)-QR-74-03). NTIS $3.25.

See also AD-784899 and AD/A-003676.

The report summarizes progress made during the quarter from 1 May 1974 to 31 July 1974 on the VELA Network Evaluation and Automatic Processing Research program. The six tasks of the program are: evaluation of the Very Long Period Experiment (VLPE) stations; investigation of the detection and discrimination characteristics of a seismic network using VLPE, NORSAR, and ALPA data; investigation of signal detection techniques; investigation of signal detection techniques; investigation of signal estimation techniques; investigation of discrimination techniques using first-zone data; and, simulation of a seismic surveillance system consisting of a network of seismic stations. (GRA)

553 (AD/A-003676) VELA NETWORK EVALUATION AND AUTOMATIC PROCESSING RESEARCH. Quarterly Report No. 4, 1 August–31 October 1974. Swindell, W. H. (Texas Instruments, Inc., Dallas (USA)). 15 Nov 1974. Contract F08606-74-C-0033. 14p. (TI-ALEX-(01)-QR-74-04). NTIS $3.25.

See also report dated 15 May 1974, AD-784899.

The report summarizes progress made during the quarter from 1 August 1974 to 31 October 1974 on the VELA Network Evaluation and Automatic Processing Research program. The six tasks of the program are: evaluation of the Very Long Period Experiment (VLPE) stations; investigation of the detection and discrimination characteristics of a seismic network using VLPE, NOSAR, and ALPA data; investigation of signal detection techniques; investigation of signal estimation techniques; investigation of discrimination techniques using first-zone data; and simulation of a seismic surveillance system consisting of a network of seismic stations. (GRA)

554 (AD/A-003682) B-1 UNIQUE SIGNAL TRAIN GENERATION APPLICATION STUDY. Final Report, 1 May–30 June 1974. Mandell, A. R.; Costello, E. M.; Hightower, D. E. (Boeing Aerospace Co., Seattle, Wash. (USA)). Nov 1974. Contract F33657-72-C-0600. 85p. (D-229-10363-1). NTIS $4.75.

The background requirement which underlies this study is consideration by the US Atomic Energy Commission of the incorporation of a device in aircraft-delivered nuclear weapons which would be an additional series safety device in the weapon pre-arm circuits. This device would be operated by a pulsating direct current signal whose format and implementation would be so unique that the possibility of its generation and application to the weapon by any means other than deliberate personnel action would be insignificantly small. (GRA)

555 (AD/A-003690) SEISMIC WAVE PROPAGATION AND EARTHQUAKE CHARACTERISTICS IN ASIA. Final Report, 1 April–30 September 1974. Kisslinger, C.; Engdahl, E. R.; Boucher, G.; Ganse, R. (Cooperative Inst. for Research in Environmental Science, Boulder, Colo. (USA)). 30 Oct 1974. Contract F44620-74-C-0015. 72p. NTIS $4.25.

See also semiannual technical rept. No. 1, dated 30 Apr 74, AD-779933.

Topics discussed include effects of plate structure on the de-

termination of earthquake focal mechanisms; AP travel-time residual study of the Hindu Kush Region; long period body wave studies of Asian seismic events; and classification of Asian earthquakes. (GRA)

556 (AD/A-003929) SHOCKTUBE FOR BLAST-FIRE INTERACTION STUDIES. Final Report. Martin, S. B.; Cook, C. J.; Goodale, T. (Stanford Research Inst., Menlo Park, Calif. (USA)). 30 Aug 1974. Contract DAHC20-72-C-0406. 68p. NTIS $4.25.

This summary report covers DCPA Contract DAHC20-C-0406 for R and D work aimed at developing a prototype shocktube facility for the study of blast-fire interactions and evaluating the practical utility of the concept by simulating the interactions between blast and fire in an urban target. (GRA)

557 (AD/A-004219) ANALYSIS OF THE MUTUAL INDUCTANCE PARTICLE VELOCIMETER (MIPV). Final Report, June 1973–June 1974. Renick, J. D. (Air Force Weapons Lab., Kirtland AFB, N. Mex. (USA)). Nov 1974. 133p. (AFWL-TR-74-205). NTIS $5.75.

Three analytical areas supporting development of the mutual inductance particle velocimeter (MIPV) are investigated. First, the basic theory is extended to permit calculation of gage factors and determination of design criteria for complex geometry gages. A finite element model is developed to investigate the effects of divergent/off-axis flow upon the gage response. Finally, an electromechanical mathematical model of the gage is developed to investigate the effects of shock-induced self-inductance and resistance charges upon gage response. (GRA)

558 (AD/A-004295) FAILURE ANALYSIS BY STATISTICAL TECHNIQUES (FAST). Volume 1. User's Manual. Final Report, 1 April 1973–30 April 1974. Rowan, W. H.; Farrell, J. J.; Nii, A. S.; Lipner, N.; Oliver, J. D. (TRW Systems Group, Redondo Beach, Calif. (USA)). 31 Oct 1974. Contract DNA001-73-C-0222. 129p. (TRW-24006-001-RU-00). NTIS $5.75.

The document is a user's manual for the FAST (Failure Analysis by Statistical Techniques) computer code. FAST is a technique for performing a statistical evaluation of the survivability of military or civilian systems subjected to a hostile environment such as would be caused by a nuclear burst or earthquake. The document contains a description of the analysis formulation, the inputs needed to perform system assessment studies, and the code and its operation, and a demonstration of the code operation through documentation of a sample problem which has been designed to address the key aspects of the methodology and its practical application. The two volumes of the document are those of Volume I, User's Manual, and Volume II, User's Manual (Appendices). The code itself was developed by TRW Systems Group over the past decade, mainly for MINUTEMAN under sponsorship of the Air Force Space and Missile Systems Organization (SAMSO). (GRA)

559 (AD/A-004479) APPLICATION OF ADVANCED METHODS FOR IDENTIFICATION AND DETECTION OF NUCLEAR EXPLOSIONS FROM THE ASIAN CONTINENT. Semiannual Report. Bache, T. C.; Cherry, J. T.; Savino, J. M. (Systems, Science and Software, La Jolla, Calif. (USA)). Oct 1974. Contract F44620-74-C-0063. 139p. (SSS-R-75-2483). NTIS $5.75.

Results of a continuing effort to obtain an optimum multidiscriminant/detection procedure for earthquakes and explosions occurring within the Asian Continent are reported. Significant improvement of theoretical predictions of teleseismic ground motion from explosions was realized using a deterministic computer model which merges nonlinear shock code calculations with far-field stress wave propagation through a realistic earth structure. The addition to the seismic codes of the Thomsom-Haskell matrix formulation and a split earth structure capability provides for the inclusion of more realistic earth structure models in the near source and receiver regions and for the intervening path in the upper mantle. The resulting theoretical seismograms show a striking similarity to observations and indicate that a successful matched filter for event detection and discrimination, based on a substantial portion of an event signal, can be constructed. (GRA)

560 (AD/A-004486) RAYLEIGH WAVES FROM HIGH GAIN LONG-PERIOD STATIONS: SIGNAL EXTRACTION; AMPLITUDE DETERMINATION; AND SEPARATION OF OVERLAPPING WAVE TRAINS. Berg, E. (Hawaii Univ., Honolulu (USA). Hawaii Inst. of Geophysics). Sep 1974. 57p. (HIG-74-10). NTIS $4.25.

Rayleigh waves are extracted and amplitudes (with standard errors) and origin time (within a few seconds) determined by use of reference earthquakes or explosions, high pass (HP) and normalized matched (NM) (or correlation) filters, and the oceanic group-velocity dispersion between 38 and 18 seconds. For a signal-to-noise ratio between 0.2 and 0.1 on the original single-component records, amplitudes for Rayleigh waves over oceanic paths of 155 degrees at station MAT and 98 degrees at station KIP have been determined as 12 m(mu) (10 digital units) and 24 m(mu) (25 digital units) peak-to-peak (p-p), respectively, with a standard error of less than 11%. In each case the processed signal is the highest in a half-hour processed record. The method also provides high resolution of co-located events with short time separation, or widely spaced events with Rayleigh waves arriving nearly simultaneously at a single station. (GRA)

561 (AD/A-004677) EFFECT OF GROUND REFLECTION ON OBSERVED EMP WAVEFORMS. Messier, M. A. (Mission Research Corp., Santa Barbara, Calif. (USA)). 11 Sep 1974. Contract DNA001-73-C-0118. 98p. (MRC-R-78). NTIS $4.75.

Techniques and results are given for predicting EMP ground reflections from high altitude nuclear bursts including pulse penetration into the ground and signal polarizations. (GRA)

562 (AD/A-004820) COUNTEREVASION STUDIES. Semiannual Technical Report No. 3 (Part B), 1 May–31 October 1974. Lane, S. S.; Sun, D. (Texas Instruments, Inc., Dallas (USA)). 30 Nov 1974. Contract F44620-73-C-0055. 34p. (TI-ALEX-(02)-TR-74-03-Pt-B). NTIS $3.75.

See also report dated 15 Nov 1973, AD-778956.

In Semi-Annual Technical Report No. 2—Part B, a detailed description of the complex cepstrum was given, and the effect of exponentially weighting the input trace was discussed from a theoretical point of view. The limit of the cepstrum technique as applied to synthetic mixtures of underground nuclear explosions was found to be about 0.5 seconds, and an example of a presumed multiple underground nuclear explosion was analyzed. The purpose of the present report is to develop a more effective form of comb filter for the cepstrum, and to investigate the limit to which the depth phase from underground nuclear explosions can be resolved. A matched waveform filter has been developed to aid in the solution of these problems. Subsection B discusses the theoretical basis for the comb and matched waveform filters. Subsection C is concerned with synthetic mixtures of direct and depth phases from presumed underground nuclear explosions. (GRA)

563 (AD/A-004825) SOME NOTES ON LONG-PERIOD SIGNALS. Quarterly Report, 1 July–30 September 1974. Greenfield, R. (Ocean and Atmospheric Science, Inc., Dobbs Ferry, N. Y. (USA)). Nov 1974. Contract F44620-74-C-0066. 49p. (OAS-TR-74-252). NTIS $3.75.

The problem investigated was the one of long-period signals (30 to 60) from a single three-component seismometer to determine the Love and Rayleigh components of an explosive event in the presence of noise or an interfering earthquake. A review of current knowledge concerning long-period noise characteristics and interfering earthquake signals is made. In addition, a review of work concerning experimental studies of ellipticity is made. (GRA)

564 (ORNL-TM-5017) ESTIMATED POTENTIAL RADIATION DOSE FROM TRITIUM IN GASOLINE PRODUCED FROM OIL SHALE BY USE OF NUCLEAR EXPLOSIVES. Sweeton, F. H.; Barton, C. J. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 19p. Dep. NTIS $4.50.

Recovery of oil from shale by use of nuclear explosives has been proposed. The principal radiological impact of this application of nuclear explosives would be expected to result from introduction of tritium into hydrocarbon products, including gasoline. The potential radiation dose that could result from tritiated gasoline is estimated by assuming that all gasoline used in the metropolitan Denver area in 1971 contained 5 microcuries of tritium per gallon. The tritium would be converted to HTO and released from automobile exhausts at ground level. Traffic counts at various locations in the area together with a national average value for gasoline consumption was used to estimate tritium release rates in each of 400 four-km^2 areas into which the metropolitan area was divided. This information, together with annual average meteorological data from the Denver area, provided input to the AIRDOT computer code which calculates doses from dispersed atmospheric radioactivity releases. The estimated highest potential dose to a continuously exposed individual is 0.006 m Rem/y and the potential population dose to 1.06 million people living in the area is 2.3 man-Rem/y. These figures can be compared with the estimated background radiation dose from natural sources in Colorado of 164.6 m Rem/y which results in a population dose to 1.06 million people of 175,000 man-Rem/y. (auth)

565 WORKING OUT THE LEGAL BASES FOR CONTROL ON NON-PROLIFERATION TREATY IN IAEA. Chapter 2. Misharin, V. N. pp 62-97 of Atom and Peace. Non-Proliferation Treaty and International Atomic Energy Agency. Morokhov, I. D. (ed.). Moscow; Mezhdunarodnye Otnosheniya (1974). (In Russian)

Work of the committee on developing legal bases for control in the carrying out of the treaty on non-proliferation of nuclear weapons and typical agreements on control are presented. The control system developed by the IAEA covers almost all stages of the nuclear fuel cycle. All operations on control and guarantees are regulated according to international agreements (groups of states) and IAEA and the IAEA system of guarantees. The interaction of national systems of control on nuclear materials with IAEA inspection activities is shown. The problem of financial control is examined along with international responsibility for states included in the agreements in case of breakage of the treaty. (INIS)

566 ENGINEERING BASE OF IAEA CONTROL. Chapter 4. Ryzhov, M. N. pp 113-125 of Atom and Peace. Non-Proliferation Treaty and International Atomic Energy Agency. Morokhov, I. E. (ed.). Moscow; Mezhdunarodnye Otnosheniya (1974). (In Russian)

It is shown that the document developed by the committee on guarantees, in which the technical bases of guarantees are considered, ensures effective IAEA control of nuclear materials used in peaceful activities by non-nuclear states participating in the treaty on non-proliferation of nuclear weapons. (INIS)

567 SIGNING AGREEMENTS ON CONTROL IN ACCORDANCE WITH NON-PROLIFERATION TREATY. Chapter 3. Palenykh, I. M.; Tikhonravov, D. N. pp 98-112 of Atom and Peace. Non-Proliferation Treaty and International Atomic Energy Agency. Morokhov, I. D. (ed.). Moscow; Mezhdunarodnye Otnosheniya (1974). (In Russian)

Processes of negotiations of non-nuclear state participants in agreements on non-proliferation of nuclear weapons and IAEA, of states not possessing nuclear weapons but carrying out nuclear activities, and of IAEA are analyzed. The state of affairs including control agreements in examined. (INIS)

568 NUCLEAR POWER FOR CONSTRUCTIVE USE. Subrahmanyan, K. (Institute for Defence Studies and Analyses, New Delhi (India)). Yojana.; 18: No. 13, 21-22(1 Aug 1974).

The philosophy underlying the development of nuclear technology in India and the stand taken by the Government of India in conducting the recent nuclear explosion are explained. It is pointed out that the Indian stand on the test explosion for peaceful purposes will probably become a starting point for nuclear deproliferation among the nuclear weapons powers and a realistic reappraisal of the unviable Non-Proliferation Treaty. (INIS)

569 NON-PROLIFERATION TREATY—IMPORTANT INSTRUMENT OF PEACE STRENGTHENING AND INTERNATIONAL SAFETY. Chapter 1. Antyasov, M. V. pp 11-61 of Atom and Peace. Non-Proliferation Treaty and International Atomic Energy Agency. Morokhov, I. D. (ed.). Moscow; Mezhdunarodnye Otnosheniya (1974). (In Russian)

The means for going from the first proposals for non-proliferation of nuclear weapons to a treaty in this area is one of the most important agreements in post-war international relations. The bases of the proposed treaty are analyzed, and the role of the IAEA in executing the treaty is discussed. (INIS)

570 PEACEFUL NUCLEAR EXPLOSION. Devaki Nandan (Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.). Vaigyanik.; 6: No. 2, 9-12, 40(Apr 1974). (In Hindi).

A brief account of the peaceful underground explosion of an Indian nuclear device in the Rajasthan Desert on May 18, 1974 is given. It was a fully contained explosion. The likely peaceful applications of such devices in India are discussed. (INIS)

571 PROCEDURE FOR REALIZING A SYSTEM PRODUCING ELECTRIC ENERGY AND A SYSTEM OBTAINED BY THIS PROCEDURE. Roland, Emile. (To Geonuclear Nobelpaso S. A., Geneva (Switzerland)). Swedish Patent 537077/D/. 29 Jun 1973. 2p. (In French).

A procedure is given for the realization of an installation producing electrical energy which is capable of producing high-power, short-duration power by the action of a compressed air turbine. The compressed air is stored in an underground cavity formed by a nuclear explosion. The installation obtained by this procedure consists of a compressed air reservoir, an air compressor, and a turbine-generator group fed by the reservoir. (tr-INIS)

572 EFFECT OF TEMPERATURE STRUCTURE ON THE INITIAL ACCELERATION OF A SPHERICAL THERMAL. Hains, F.D. (Science Applications, Inc., McLean, Virginia 22101). Phys. Fluids 18: No. 9, 1213-1214 (Sept 1975).

The internal vortex motion observed in nuclear fireballs as they begin to rise is due to differential buoyancy associated with its internal temperature structure, rather than to viscous effects. (auth)

573 FORMATION OF AN UNDERGROUND HOLLOW WITH AN INNER EXPLOSION IN AN ISOTROPIC ROCK MASSIF. Vovk, A. A.; Mikhalyuk, A. V.; Belinskii, I. V. Prikl. Mekh.; No. 9, 53-59(1974). (In Russian).

A computational apparatus is developed for determining the parameters of the subterranean hollow made by the underground explosion of a nuclear charge. A table is given of the characteristics of various types of rock with which experiments involving underground explosions were conducted. For engineering computations, it can be assumed that there is a linear relationship between the stresses and the deformations. On this basis, a computational model of mountain rock is derived; a curve for this model is reproduced. The effect of underground explosions on rock massifs is considered on the assumption that the dimensions of the hollow are determined only by irreversible thickening of the rock around the focus of the explosion. It is found that in mountain rock with an elastic-plastic equation of state, the dimensions of the underground hollow formed by an underground blast are directly proportional to the radius of the blasting charge. A table is given of some initial data and computational results. (JPRS)

574 DEBATE OVER THE HYDROGEN BOMB. York, H. F. Sci. Am.; 233: No. 4, 106-113(Oct 1975).

The background of the 1949 debate among US scientists on the AEC's General Advisory Committee over the advisability of developing the hydrogen bomb is reviewed, the consequences of the US government rejecting the recommendations of that committee are discussed, and the chronology of subsequent H bomb development in the US and USSR is presented. (LCL)

Protective Structures and Equipment

Refer also to abstracts 171 and 2489.

Safety Engineering

Refer also to abstract 1403.

575 (CONF-750628-2) MANAGEMENT OVERSIGHT AND RISK TREE (MORT): A NEW SYSTEM SAFETY PROGRAM. Clark, J. L. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). [nd]. 17p. Dep. NTIS $4.50.

From system safety conference; San Diego, California, USA (21 Jul 1975).

Experiences of Aerojet Nuclear Company (ANC), in the development and implementation of a system safety program for ANC and for the Energy Research and Development Administration (ERDA) are discussed. Aerojet Nuclear is the prime operating contractor for ERDA, formerly AEC, at the Idaho National Engineering Laboratory. The ERDA sponsored "MORT" system safety program is described along with the process whereby formal system safety methods are incorporated into a stable organization. Specifically, a discussion is given of initial development of MORT; pilot program trials conducted at ANC; implementation methodology; and reaction of the ANC organization. (auth)

Vacuum Engineering

Refer also to abstract 811.

ENVIRONMENTAL AND EARTH SCIENCES

576 (AD/A-003735) LONG PERIOD SEISMOLOGICAL RESEARCH PROGRAM. Semiannual Report. Sykes, L. R. (Columbia Univ., Palisades, N. Y. (USA). Lamont-Doherty Geological Observatory). 31 Oct 1974. Contract F44620-71-C-0082. 23p. NTIS $3.25.

See also report dated 29 Oct 73, AD-778950.

Topics discussed include station maintenance; results of the data analysis; surface waves from events in Central Asia; very-long-period microseims; and test for non-linearity of response. (GRA)

577 (ANL/ES-40(Vol.2)) ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION. Volume 2. Physical Limnology of Lake Michigan. Part 1. Physical Characteristics of Lake Michigan and Its Responses to Applied Forces. Part 2. Diffusion and Dispersion. Mortimer, C. H.; Csanady, G. T. (Argonne National Lab., Ill. (USA)). Jun 1975. Contract W-31-109-Eng-38. 121p. Dep. NTIS $5.45.

Separate abstracts were written for the two sections of the report. (SFL)

For abstracts of individual sections see: 578 and 579.

578 (ANL/ES-40(Vol.2), pp 13-102) PHYSICAL CHARACTERISTICS OF LAKE MICHIGAN AND ITS RESPONSES TO APPLIED FORCES. Mortimer, C. H. Jun 1975.

In environmental status of the Lake Michigan region. Volume 2. Physical limnology of Lake Michigan. Part 1. Physical characteristics of Lake Michigan and its responses to applied forces. Part 2. Diffusion and dispersion. (Argonne National Lab., Ill. (USA)).

Basin geomorphology, water budget, light penetration, and the heat budget terms are discussed. More extensive examination is given to gravitational and frictional forces acting upon the water body, Coriolis force, and interactions between the vertical fluxes of wind-induced turbulence and heat-related buoyancy. Representative responses of the Lake to applied wind forces are: wind-driven currents and near-shore geostrophic (Coriolis-balanced) currents, generally unidirectional but subject to frequent direction changes and reversals, and periodic currents generated by waves, principally long internal and surface waves in the form of seiches modified by the earth's rotation, constituting the free modes of oscillation of the basin. After winter circulation, the annual temperature cycle begins with the thermal bar phase of spring warming, followed by stratification in summer and fall. After stratification, wind stress and Coriolis force combine to produce frequent and extensive upwellings. These forces generate geostrophic currents near shore and internal waves of several kinds, including those of near-inertial period (15 to 17 hr), producing rotating currents conspicuous in offshore waters. Near shore, the previously mentioned unidirectional (including Kelvin wave) responses predominate. (auth)

579 (ANL/ES-40(Vol.2), pp 103-121) DIFFUSION AND DISPERSION. Csanady, G. T. Jun 1975.

In environmental status of the Lake Michigan region. Volume 2. Physical limnology of Lake Michigan. Part 1. Physical characteristics of Lake Michigan and its responses to applied forces. Part 2. Diffusion and dispersion. (Argonne National Lab., Ill. (USA)).

The local concentration of a conservative pollutant in Lake Michigan depends on the rate at which some discharged batch mixes with ambient waters and thereby expands in size. The physical mechanism of such growth of pollutant-batches is discussed in terms of several theoretical models which have appeared in the literature over the years, in order to throw light on the important processes involved in pollutant disposal. Simple means of estimating pollutant concentration are then briefly described, to allow the assessment of nuisance or hazard associated with the release of pollutants in the lake. (auth)

580 (COM-75-10098) LOCATING OFFSHORE MINERAL DEPOSITS BY NATURAL RADIOACTIVE MEASUREMENTS. Noakes, J. E.; Harding, J. L.; Spaulding, J. D. (Georgia Univ., Athens (USA)). Jun 1974. 6p. NTIS $3.25.

Information is given on current research, instrumentation involved in a rapid survey analysis system, a static system, an underwater vehicle sled system, and a specific isotope identification system. The tools and techniques described in this paper were tested and found to be reliable under strenuous field conditions. The application of natural radioactive tags associated with certain marine mineral deposits is a unique application of nuclear technology. (GRA)

581 (SAND-75-0036) EXPERIMENTAL STUDY OF THERMALLY INDUCED BUOYANT PLUMES IN WATER. Schimmel, W. P. Jr.; Sullivan, W. N. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1975. Contract AT(29-1)-789. 23p. Dep. NTIS $4.50.

A preliminary experimental study was made of the velocity and temperature fields above a localized heat source in water. Temperature profiles were obtained by a laser holographic interferometry technique, while the velocity field was visualized by injecting dye in a large water tank. Results of the study are qualitatively compared with earlier theoretical predictions. (auth)

582 (SREL-5) BIBLIOGRAPHY FOR THE OLD-FIELD MOUSE, PEROMYSCUS POLIONOTUS WAGNER (RODENTIA). Felley, J. D.; Smith, M. H. (Savannah River Ecology Lab., Aiken, S. C. (USA)). 1 Jun 1975. 41p. Dep. NTIS $5.25.

Two hundred and eighty-two references to studies on the old-field mouse are listed alphabetically. They are classified into 21 categories which are listed at the beginning and category numbers are given with each citation. A computer program for searching the data base is available. (HLW)

Minerals and Ores

Refer also to abstracts 537, 784, and 994.

583 (DEMO-75/6) GEOPLOT. Georgiou, D. N. (ed.). (Democritus Nuclear Research Center, Athens (Greece)). 1975. 81p. Dep. NTIS (US Sales Only) $7.25.

Geoplot forms a series of eight programs that plot maps of geochemical or other data. They are written in Fortran for a CDC 3300 computer and a Calcomp 565 drum plotter connected to the computer. Geoplot can plot crosses for sample location, crosses with sample numbers, crosses with the real analytical values of elements, integer numbers from 0 to 9 indicating simultaneously sample positions and classes of values, integer numbers in different colors, integer numbers from 0 to 9 in grid positions to cover the whole map area, with regions of different value levels. The map may be easily contoured by hand, or left as it is. It also plots big reference crosses and a title of four characters beside them. Geoplot has been used successfully in uranium exploration. (auth)

584 (PB-238819) FORECASTS OF THE EFFECTS OF AIR AND WATER POLLUTION CONTROLS ON SOLID WASTE GENERATION. Final Report. Stone, R.; Brown, D. E. (Stone (Ralph) and Co., Inc., Los Angeles, Calif. (USA)). Dec 1974. Contract EPA-68-03-0244. 830p. NTIS $19.25.

The effects of air and water pollution controls on solid waste generation were evaluated. The solid wastes from pollution control were identified for individual industrial sectors by their original air or water pollutant constituents, and the treatment process applied. The wastes were categorized by type and by location (rural or urban). Total solid wastes from pollution control activities were estimated for 1971 and projected for 1975, 1980, and 1985. Particulates and sulfur oxides were identified as the major air pollutants capable of generating solid wastes when treated; suspended solids and biological oxygen demand were identified as the principle sources for the impact of water pollution control on solid wastes. Important sectors generating solid wastes included power plants, paper and pulp, chemicals, cement and clay, steel furnaces, nonferrous smelting and refining, sewage systems, and uranium mining. An 83 page executive summary is available separately (EPA-670/2-74-095a). (GRA)

585 RELATION BETWEEN THE URANIUM MINERALIZATION AND SODIUM METASOMATITE FORMATION. Grechshinikov, N. P.; Zinchenko, V. A.; Kramar, O. A.; Nikolaenko, V. I.; Smolin, N. V.; Popov, N. I.; Obrizanov, V. N.: Stekhina, M. Z. Geol. Zh. (Russ. Ed.); 34: No. 1, 75-84(Jan 1974). (In Russian).

In a study of a sodium-uranium formation the deposit was shown to be related to the type of epimetasomatic, combined with sodium metasomatites, developed in the deep zones with two stages of mineralization. The first, or the basic, stage is separated into two substages, in the first of which are formed sodium metasomatites which in the initial part of the second substage are cataclased and brecciated. After this small-grain albite is formed by cementing of particles of cataclasites, quartz, and associated dark-colored minerals. In this second substage the basic mass of uranium minerals precipitates. The temperature of formation of

albite I is 205-208°C and of albite II (small-grain), 140-180°C. In the second stage, minerals of later generation are formed, whose temperature of formation is 120-140°C. Uranium is localized almost exclusively in intermediate and dark-colored albitites. The most mineralized are the apomigmatic and intermediate and dark-colored apogranitic albitites where the amount of dark-colored deposits varies from 5 to 10%. Light-colored apogranitic albitites, in which the dark-colored minerals are less than 1–2%, as a rule are non or slightly mineralized. The porosity and penetrability of the albitite ores themselves is highest of all rocks in the deposit. Thus the physico-mechanical and chemical properties of the ores are the most important factors in localization of uranium minerals in sodium metasomatites. (tr-INIS)

586 MINERALOGY OF THE WITWATERSRAND REEFS. Feather, C. E.; Koen, G. M. (Anglo American Research Labs., Crown Mines, S. Afr.). Miner. Sci. Eng.; 7: No. 3, 189-224 (Jul 1975).

Information on the mineralogy of the Witwatersrand and contiguous reefs is reviewed. Areas where knowledge is wanting and where further research is warranted are identified. Various minerals, including uraninite, are discussed. (auth)

587 AIRBORNE GEOPHYSICS AND ERTS IMAGERY. Richards, D. J.; Walraven, F. (Geological Survey of South Africa, Pretoria). Miner. Sci. Eng.; 7: No. 3, 234-278(Jul 1975).

The methods and techniques of airborne geophysics are described and explained to enable the field geologist to plan, supervise, and interpret airborne magnetic and radiometric surveys. The acquisition and interpretation of ERTS images are also described and examples of important correlations between ERTS imagery and airborne geophysics in South Africa are presented. The use of airborne γ spectrometry to enable the estimation of relative abundances of K, U, and Th in the topmost part of the earth's crust is discussed. (auth)

588 GEOMICROBIOLOGICAL STUDIES ON URANIUM ORES AND DEVELOPMENT OF A BACTERIAL LEACHING MODEL. Ebner, H. G. Brunswick; Technische Univ. (1972). vp. (In German). INIS.

Thesis.

Basic aspects of bacterial leaching, and experiments with uranium ores from FRG mines and some types of thiobacteria are described. The experimental results are discussed along with the problem of optimalization of the leaching procedure and combined chemical-microbiological leaching. (GE)

Radioactive Effluents

589 (INIS-mf-1236, pp 3-9) INFLUENCE OF INDUSTRY ON RADIOACTIVE POLLUTION OF ENVIRONMENT. Jaworowski, Z.; Bilkiewicz, J. (Centralne Lab. Ochrony Radiologicznej, Warsaw). 1972.

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In radioactive pollution of environment. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)).

The concentrations of radium-226 in the snow samples collected around a power station in Warsaw has been found to be related to the distance from the plant, ranging from 0,019 to 0,98 pCi/kg. The concentrations of radium-226 in glacier ice samples raised from 0,004 pCi/kg in 1880 year to 0,206 pCi/kg in 1970. These changes are supposed to be caused by indistrial combustion of fossil fuel. (INIS)

590 (INIS-mf-1236, pp 138-149) RADIATION PROTECTION PROBLEMS OF DISCHARGE LOW RADIOACTIVITY WASTE WATERS FROM LABORATORIES INTO SEWER SYSTEMS AND SURFACE WATERS. Kunert, J. (Staatliche Zentrale fuer Strahlenschutz, Berlin). 1972. (In German).

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In radioactive pollution of environment. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)).

Comments are given on GDR regulations concerning the discharge of waste water into sewer systems and surface waters from installations and laboratories working with radioactive materials. The radiation protection is discussed which may result, even when the regulatory criteria are fully met. It is pointed out that these problems will arise only in certain cases. Thus, however, the regulations must be applied formally. Finally some objectives of radiation protection surveillance in the GDR are outlined. (INIS)

591 (INIS-mf-1236, pp 191-216) EVALUATION OF THE USEFULNESS OF INDIGENOUS ION-EXCHANGE RESINS FOR REMOVAL OF RADIOACTIVE STRONTIUM, CESIUM, AND IODINE FROM MILK. Kornacki, K.; Poznanski, S. (Wyzsza Szkola Rolnicza, Olsztyn, Poland). 1972.

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In radioactive pollution of environment. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)).

The following ion-exchangers produced in Poland were tested for their suitability in the removal of radioactive strontium, caesium and iodine from milk: SD-product of the Chemical Cooperative Xenon in Lódź; FPC, LF, MG and FD-products of the Gamrat Laboratory in Jasloń; MK-2, MK-3 and GM-800 - products of the Nitrogen Plant in Kedzierzyn. For comparison, the Amberlite IR-120 (USA) cation exchanger and Dowex 2 x 8 (USA) anion exchanger was applied. The composition of the regenerating solutions used for converting the H^+ form of the cation-exchange resins studied into the Ca^{++}, K^+ and Na^+ formes were experimentally determined. The composition of the buffer solution for transforming the anion-exchange resins was investigated, and so were thermodynamic conditions for milk decontamination and complete eluation of the absorbed radionuclides. As the pH of milk was decreased, the degree of removal of radioactive strontium increased with all the cation-exchange resins investigated. It was found that for removal of Sr-90 and Cs-137 most suitable are the cation exchangers SD and MK-3 respectively, the latter being superior to the standard Amberlite IR-120. From four anion-exchange resins (LF, MG, FD and GM-800) only LF is fully efficient in removing I-131 from milk. It is no worse in this respect from the ion exchanger Dowex 2 x 8 used in USA, United Kingdom and Canada for milk decontamination on a commercial scale. (INIS)

Radioactivity Monitoring and Transport

Refer also to abstracts 589, 1409, and 2541.

592 (AECL-5178, pp 25-42) ENVIRONMENTAL RESEARCH BRANCH. Ophel, I. L. May 1975.

In Biology and Health Physics Branch. Progress Report, 1 January–31 March 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Progress is reported on research on effects of heated water on aquatic organisms; chemistry of lake sediments; uses of waste heat; aquatic radioecology; effects of internally deposited radionuclides in fish on lethal level of dissolved oxygen; neutron activation analysis; gamma dose rates at CRNL boundary; off-site monitoring; and liquid effluent monitoring. (HLW)

593 (ARH-R-178) ASSESSMENT OF GROUNDWATER MANAGEMENT AT HANFORD. Deju, R. A. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 11 Feb 1975. 15p. Dep. NTIS $4.50.

A comprehensive review of the groundwater management and environmental monitoring programs at the Hanford reservation was initiated in 1973. A large number of recommendations made as a result of this review are summarized. The purpose of the Hanford Hydrology Program is to maintain a groundwater surveillance network to assess contamination of the natural water system. Potential groundwater contamination is primarily a function of waste management decisions. The review revealed that although the hydrology program would greatly benefit from additional improvements, it is adequate to predict levels of contaminants present in the groundwater system. Studies are presently underway to refine advanced mathematical models to use results of the hydrologic investigation in forecasting the response of the system to different long-term management decisions. No information was found which indicates that a hazard through the groundwater pathway presently exists as a result of waste operations at Hanford. (CH)

594 (BNL-tr-612) SORPTION OF ^{239}Pu, ^{106}Ru, AND ^{99}Tc BY BOTTOM SEDIMENTS IN THE PACIFIC OCEAN. Gromov, V. V.; Spitsyn, V. I. Translated From Radiokhimiya; 16: No. 2, 157-162(1975). 19p. Dep. NTIS $4.50.

The absorption of trace amounts of ^{239}Pu, ^{106}Ru, and ^{99}Tc by the most abundant sediments of the Pacific Ocean (deep-water red clay, carbonate sediment, diatomic silt, and hydrogenous sediment was investigated. The radioactive products were found to be sorbed most efficiently by red clay and carbonate sediment. The radioactive isotopes studied may be arranged in the following sequence relative to the degree of absorption: ^{106}Ru greater than ^{239}Pu greater than ^{99}Tc. Several equilibrium physicochemical forms were shown to correspond to the given radioactive isotopes in sea water:

^{106}Ru has several sorbable forms, ^{239}Pu is characterized by at least one sorbable and one nonsorbable form, and ^{99}Tc presumably exists in the form of a not readily sorbable anion, TcO_4^-. (auth)

595 (BNWL-1697(Rev.1)) CONSIDERATIONS IN THE ASSESSMENT OF THE CONSEQUENCES OF EFFLUENTS FROM MIXED OXIDE FUEL FABRICATION PLANTS. Selby, J. M.; Watson, E. C.; Corley, J. P. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1975. Contract E(45-1)1830. vp. Dep. NTIS $5.45.

The purpose of this study was to provide information and identify parameters relevant to assessing the consequences to man and his environment of large scale mixed plutonium-uranium oxide fuel fabrication plants which will be needed in the next 10 to 15 years. The report identifies the pertinent parameters, values, factors and methods which may be used in evaluating the environmental consequences of routine plant operation as well as postulated accidents. This study provides a base for the development of siting criteria and safety analyses for mixed oxide fuel fabrication facilities. (auth)

596 (BNWL-B-368) RECOMMENDATIONS CONCERNING THE COMPUTATION AND REPORTING OF COUNTING STATISTICS FOR THE NEVADA APPLIED ECOLOGY GROUP. Gilbert, R. O. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1975. Contract E(45-1)-1830. 75p. Dep. NTIS $5.45.

Recommendations are made concerning the computation and reporting of count statistics relative to the analysis of environmental samples for plutonium, uranium, and other radionuclides. Computational formulas are given for determining whether contamination above background level exists in the sample; computing confidence intervals about the true net counting or disintegration rate of the sample; determining the minimum true net disintegration rate that will be detected most of the time; and reporting of net counts and their associated counting errors. (CH)

597 (BNWL-SA-5393) ACCUMULATION OF TECHNETIUM FROM SOIL BY PLANTS: A POTENTIAL MECHANISM FOR UPTAKE AND TOXICITY. Wildung, R. E.; Garland, T. R.; Cataldo, D. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1975. Contract AT(45-1)-1830. 13p. (CONF-750847-2). Dep. NTIS $4.00.

From annual meeting of the American Society of Agronomy; Knoxville, Tennessee, USA (24 Aug 1975).

The isotope ^{99}Tc ($T_{1/2}$, 2.15×10^5 years) is produced by the spontaneous fission of ^{238}U in nature and by the slow neutron fission of ^{235}U in nuclear reactors. In the latter case, the potential exists for Tc entrance into the environment in emissions from nuclear reactors, nuclear fuel reprocessing plants, and other facilities which use Tc for commercial purposes. Results are reported from studies on Tc uptake by plants. The most stable chemical species of Tc in aqueous solution is the pertechnetate ion (TcO_4^-), and it is this form which is most likely to enter surface soils. Recent studies indicated that at least over the short term, pertechnetate is soluble and highly mobile in most soils and is sorbed in significant quantities only in high organic matter, low pH soils. Plant availability normally increases with increased ion solubility in soil provided the ion is not discriminated against at the plant root level. Furthermore, the aqueous chemistry of pertechnetate is similar in several respects to permanganate and molybdate, compounds of elements essential in plant nutrition. Experiments were undertaken to determine the uptake and distribution of Tc in plants as a function of time using soybeans (Glycine max) and ^{99}Tc as a tracer. (CH)

598 (BNWL-SA-5424) DISTRIBUTION OF TRANSURANIC ELEMENTS IN A FRESHWATER POND ECOSYSTEM. Emery, R. M.; Klopfer, D. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). May 1975. 23p. (CONF-750672-1). Dep. NTIS $4.25.

From 8th international conference on environmental toxicology; Rochester, New York, USA (1 Jun 1975).

Preliminary results are reported from a study initiated on the Hanford Reservation concerning the ecological behavior of ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{241}Am in a freshwater environment. This study involves a waste pond which has been receiving Pu processing wastes for about 30 years. The pond has a sufficiently established ecosystem to provide an excellent location for limnological characterization. In addition, the ecological distribution of Pu and Am was investigated. The pond is also highly enriched with nutrients, thus supporting a high level of algal and macrophyte production. Seston (30 percent diatoms) appears to be the principal concentrators of Pu transuranics in the pond system. The major sink for Pu and Am in this system is the sediments. Organic floc, overlaying the pond sediments, is also a major concentrator of transuranics in this system. Aside from the seston and floc, no other ecological components of the pond appear to have concentrations significantly greater than those of the sediment. Dragonfly larvae, watercress, and snails show concentrations which approximate those of the sediments but nearly all other food web components have levels of Pu and Am which are lower than those of the sediments, thus, Pu and Am seem to be relatively immobile in the aquatic ecosystem. (CH)

599 (BNWL-SA-5442) OCEANIC DISTRIBUTION AND GEOCHEMISTRY OF SEVERAL TRACE ELEMENTS AT GEOSECS STATIONS. Robertson, D. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 23 May 1975. Contract AT(45-1)-1830. 11p. (CONF-750673-4). Dep. NTIS $4.00.

From 30th northwest regional meeting American Chemical Society; Honolulu, Hawaii, USA (12 Jun 1975).

The biogeochemical and physical processes operating in the oceans create substantial geographical and vertical variations in the oceanic distribution of many trace elements. These variations are brought about by diverse mechanisms and involve trace elements of a wide spectrum of physicochemical and biological behavior. Thus, a knowledge of these trace element distributions can help characterize some of the ocean processes in which they participate. (auth)

600 (CONF-7306121-1) RATIONAL REFERENCE LEVELS FOR PACIFIC COAST RADIOACTIVE POLLUTION STUDIES SUPPLIED BY SAMPLES FROM NORTHERN BAJA CALIFORNIA. Folsom, T. R. (Scripps Institution of Oceanography, La Jolla, Calif. (USA). Soledad Lab.). 1974. 16p. Dep. NTIS $4.00.

From Mexican geophysical union annual meeting; Ensenada, California, USA (1 Jun 1973).

Background levels of radioactivity in the marine environment along the Pacific Coast are at present extremely low. However, these certainly will rise along with the growth of coastal populations and with the increased use of nuclear energy. It would be desirable to anticipate where and how fast concentrations of artificial radioactivities may reach unacceptable levels in coastal water. Successful prediction of this sort requires knowing how the ocean responds, in given regions, to specific inputs. Fortunately, some of the fate of a large class of radioactive pollutants that must be faced in the future may be inferred from careful studies during the past 20 years of the behavior of certain constituents of nuclear fallout that have entered the ocean along the coasts of California and Baja California. (CH)

601 (CONF-741251-1) DEPOSITION OF THE TRACE HEAVY METALS POLONIUM AND PLUTONIUM ONTO MARINE SURFACES. Hodge, V. F.; Folsom, T. R.; Cowen, J. P.; Parks, G. J. Jr. (Scripps Institution of Oceanography, La Jolla, Calif. (USA). Soledad Lab.). 13 Dec 1974. 11p. Dep. NTIS $4.00.

From annual meeting on deposition of the trace heavy metals polonium and plutonium onto marine surfaces; San Francisco, California, USA (13 Dec 1974).

Plutonium and polonium assays of the giant kelp revealed that most of the Pu and Po was in the surface scrapings. Both nuclides were concentrated to 1000 times their sea water concentrations; there was usually 200 times more Po activity than Pu. Field experiments using Macrocystis pyrifera showed that Pu and Po accumulated in proportion with time and surface area and that approximately four times more Pu and Po were found on oldest tissues. When glass microscope slides were exposed alongside living plants, deposition rates for Po were identical and Po deposited about 200 times faster than Pu. (HLW)

602 (DP-MS-75-40) FIELD STUDY TO DETERMINE PLUTONIUM CONTENTS OF WHEAT AND SOIL IN A WARM HUMID AREA. Adriano, D. C.; McLeod, K. W.; Pinder, J. E. III; Smith, M. E.; Boni, A. L.; Corey, J. C.; Horton, J. H. (Savannah River Ecology Lab., Aiken, S. C. (USA); Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(38-1)-819. 10p. (CONF-750847-1). Dep. NTIS $4.00.

From annual meeting of the American Society of Agronomy; Knoxville, Tennessee, USA (24 Aug 1975).

A field study was initiated in the fall of 1974 at the United States Energy Research and Development Administration's Savannah River Plant near Aiken, South Carolina, to determine the spatial and temporal variation of plutonium in soil-plant systems, with wheat as the crop of interest. The study was conducted on a field adjacent to a nuclear fuel reprocessing plant. Soil in this field was lightly contaminated with plutonium originating from atmospheric releases by the reprocessing plant during its 20 years of operation and from global fallout. The

plant releases provided a true industrial source of plutonium for study purposes. (auth)

603 (EGG-1183-1641) RADIOLOGICAL SURVEY OF THE AREA SURROUNDING THE ROCKY FLATS PLANT, GOLDEN, COLORADO, 3–4 MAY AND 6 OCTOBER 1972. (EG and G, Inc., Las Vegas, Nev. (USA)). 30 Sep 1974. Contract AT(29-1)-1183. 20p. Dep. NTIS $4.00.

The Aerial Radiological Measuring System (ARMS) was used to perform an aerial radiological survey of the Rocky Flats Plant and surrounding area on 3 and 4 May 1972, and again on 6 October 1972. The surveys measured terrestrial gamma radiation exposure rates. During the May survey, a series of 0.20-nautical-mile (1,216 ft) spaced lines were flown directly over the Rocky Flats Plant. This detailed survey covered an area of approximately 16 square miles (8 x 2 mi). On 6 October 1972 a series of 13 lines were flown at one-nautical-mile intervals, each 10 to 20 miles long. A high-sensitivity detection system collected gamma-ray spectral and gross-count data. The data were then computer-processed into a map of an area approximately 200 square miles, showing isoexposure contours 3 feet above the ground; the large-area results indicated the presence of isotopes normally found in the background radiation throughout the United States. No gamma activity above the nominal background exposure rate (6 mu R/hr to 22 mu R/hr) was detected outside the Rocky Flats Plant boundary. Within the plant boundary, exposure rates ranged as high as 100 mu R/hr. The present survey was conducted to measure the total gamma activity within the energy range 0.05 less than or equal to E gamma less than or equal to 3.0 MeV in the vicinity of the Rocky Flats Plant. A special survey was conducted in May 1973 to determine plutonium concentrations around the plant. (auth)

604 (ERDA-54(Vol.1)(74)) ENVIRONMENTAL MONITORING AT MAJOR U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION CONTRACTOR SITES: CALENDAR YEAR 1974. Volume I. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Operational Safety). Aug 1975. 797p. Dep. NTIS $13.60.

The purpose of the compendium is to present, in a central reference document, all of the annual reports summarizing the results of the environmental monitoring programs conducted at each of the Energy Research and Development Administration (ERDA) sites which have a potential for environmental impact or which release a significant quantity of radioactivity or nonradioactive pollutants. Each contains data on the levels of radioactivity and nonradioactive pollutants in effluents and the environs at each site, and an interpretation of effluent and environmental measurements and sampling results in relation to the appropriate standards for environmental protection, including estimates of potential radiation exposures offsite. (auth)

605 (GEAP--14052) RADIOLOGICAL RELEASE AND DOSAGE MODELS. Teresi, J. D.; Stitt, R. K. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Jun 1975. Contract AT(04-3)-893. 38p. AT.

The report presents results of studies of biological and atmospheric dispersion models. The sections on biological models include a discussion of lung deposition and clearance models, biological effects models for plutonium, and application of these to plutonium aerosols from hypothetical LMFBR accidents. The limitations of the old International Commission on Radiological Protection (ICRP) lung model and the advantages of the new Task Group Lung Model (TGLM) are discussed. Sample calculations of body burdens and absorbed organ doses from exposure to plutonium released from hypothetical LMFBR accidents are compared to practical threshold model values and to nonthreshold model tumor incidence values. (auth)

606 (INIS-mf-1236, pp 167-177) STUDIES ON THE MIGRATION OF THE ^{90}Sr AND ^{137}Cs FROM FODDER TO THE MILK IN THE CASE OF THE SINGLE COWS HERD. Jankowska, S. (Instytut Przemyslu Mleczarskiego, Warsaw). 1972.

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In radioactive pollution of environment. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)).

Long studies results to determine the ability of cumulation and discrimination coefficients of the main-fallout radionuclides in the link of the food-chain: fodder–milk are described. Cumulation coefficients are determined as a relation of radionuclide relative activity in milk and fodder. Discrimination coefficients are determined on the basis of Sr migration in respect to Ca, and Cs in respect to K. Increase of Sr-90 cumulation in the link of foodchain: fodder–milk, which was cumulated in biosphere during ages, was observed. In case of Cs-137 the tendency for seasoning disposition of the cumulation and discrimination coefficients was noted. It means that during summertime (pastures feeding) higher values appeared and lower and more balanced values appeared during winter time (cowshed feeding). (INIS)

607 (INIS-mf-1236, pp 178-190) MILK RADIOACTIVE CONTAMINATION IN POLAND BY THE MAIN RADIONUCLIDES OF THE FALLOUT (^{90}Sr AND ^{137}Cs) IN 1959–1969. Jankowska, S.; Zajac, W. (Instytut Przemyslu Mleczarskiego, Warsaw). 1972.

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In radioactive pollution of environment. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)).

The results of the milk radioactive contamination control in Poland, carried out by Institute of the Dairy Industry in Warsaw, are reported. The analysis of control results during 1958–1969 showed distinct differences in characteristic intensity of milk contamination by ^{90}Sr and ^{137}Cs. Great differences in the ratio of Cs units in milk CU/SU were noted; therefore this index didn't allow for assessment of milk contamination by ^{90}Sr on the basis of quick ^{137}Cs measurements. The distinct differences in degree of the milk contamination from different regions of Poland with tendency for distinct orientation of the "striped contamination" were observed. (INIS)

608 (INIS-mf-1236, pp 228-250) RESULTS OF FALLOUT MONITORING IN THE GERMAN DEMOCRATIC REPUBLIC IN 1969. Gegusch, H.; Kunert, J.; Schulze-Wollgast, U.; Zindler, H. (Staatliche Zentrale fuer Strahlenschutz, Berlin). (In German).

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In radioactive pollution of environment. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)).

In 1969 the results of fallout monitoring showed a further decrease of the ^{90}Sr and ^{137}Cs contamination of nearly all environmental samples. On the average the concentration of ^{90}Sr decreased more heavily than that of ^{137}Cs. The decrease of ^{90}Sr contamination of fallout, several plants (lucern, rye and wheat grain, potatoes) and milk was marked most dintinctly. The ^{137}Cs contamination of several plants (turnip, lucern, potatoes) decreased too, whereas that of milk, total diet, grass and rye grain was unchanged in comparison with 1968. (INIS)

609 (LA-6035-MS) MODEL FOR PREDICTING THE REDISTRIBUTION OF PARTICULATE CONTAMINANTS FROM SOIL SURFACES. Travis, J. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1975. Contract W-7405-Eng-36. 63p. Dep. NTIS $5.45.

A computerized model was developed to describe the redistribution of wind eroding soil-contaminant mixtures. Potentially mobile particulate contaminants can, in the first approximation, be assumed to be indistinquishable from the wind eroding soil in which they are distributed. A grid network characterizes important soil and surface conditions, and mass conserving control volumes are constructed on each cell. Material is transported through the vertical and top surfaces of a control volume by a modified Bagnold-Chepil horizontal flux formulation and modified Gillette vertical flux formulation, respectively. The vertical emissions, considered as puffs from area sources, create at regular time intervals a contaminant cloud which is proportional to the suspendable ground concentration. These puffs diffuse downwind under time-dependent wind velocity and atmospheric stability conditions, maintaining during the time interval a three-dimensional Gaussian distribution of concentration with cloud volume. Material from each puff is deposited in downwind cells, leading to the possibility of many different flights from these new sources. The usefulness of this predictive tool is demonstrated by calculations involving mixtures of particulate $^{238}PuO_2$ in highly erodible soils under dust storm conditions. Time-dependent surface concentration and breathing zone exposure isopleths, evolving from a small contaminated area, show the potential hazard from wind eroding toxic materials. (auth)

610 (LA-UR-75-1770) PLUTONIUM, AMERICIUM, AND URANIUM CONCENTRATIONS IN NEVADA TEST SITE SOIL PROFILES. Essington, E. H.; Gilbert, R. O.; Eberhardt, L. L.; Fowler, E. B. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 25p. (CONF-751105-1). Dep. NTIS $4.25.

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, California, USA (17 Nov 1975).

Many soil profile samples were collected by the Nevada Applied Ecology Group from five nuclear safety test sites on the Nevada Test Site and Tonopah Test Range in Nevada, U. S. A. The profile samples were analyzed for ^{239}Pu, ^{240}Pu, ^{241}Am, and in some cases ^{235}U and ^{238}U, in order to estimate the depth of radionuclide pene-

tration and level of contamination at specific sampling depths after an extended period of time since deposition on the surface. Nearly 70 individual profiles were examined. About one-half of the profiles exhibited a smooth leaching pattern with more than 95 percent of the plutonium in the top 5 cm. Other profile patterns are discussed relative to mechanical disturbance of the profile after the initial deposition, accumulation of plutonium in specific zones within the soil profile, and occurrence of large amounts of plutonium in the deepest parts of the soil profile. The implications of these observations are discussed with respect to redistribution of radioactivity by wind, water, and burrowing animals, ingestion by burrowing and grazing animals, uptake by vegetation, and cleanup operations. (auth)

611 (NVO-143) LONG-TERM RADIOLOGICAL SURVEILLANCE PROGRAM. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office). Mar 1975. 23p. Dep. NTIS $4.50.

The U. S. Energy Research and Development Administration (ERDA) is committed to ensure that no public safety hazard exists or has developed at any site used for nuclear experimentation. This commitment is assured through strict adherence to applicable safety regulations during active site occupation and through the use of long-term monitoring programs after site activities have terminated. This program is carried out by the Environmental Protection Agency/Environmental Monitoring and Support Laboratory-Las Vegas (EPA/EMSL-LV) under the cognizance of the ERDA/NV. The Tatum Dome Test Site, used for Project Dribble, was the site of two nuclear and two nonnuclear events between 1964 and 1970. No radioactive contaminants were released to the environment by the actual tests themselves; however, minor releases did occur in connection with reentry drilling. The site was decontaminated, restored to near preshot conditions, and deactivated in 1972. No need for bioenvironmental monitoring, soil sampling, or seismic monitoring has been demonstrated for this site. However, water from all water-bearing formations above the Cook Mountain limestone and from the surface in the vicinity of the site will be periodically sampled, including deep wells, domestic wells, surface waters, and municipal water supplies. The sampling program will continue until it can be established that the need no longer exists. Annual reports will be prepared to document the results of the program. (auth)

612 (NVO-153) RADIOECOLOGY OF PLUTONIUM AND OTHER TRANSURANICS IN DESERT ENVIRONMENTS. Nevada Applied Ecology Group Progress Report as of January 1975. White, M. G.; Dunaway, P. B. (eds.). (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office). Jun 1975. 600p. Dep. NTIS $13.60.

Separate abstracts were prepared for the 21 sections of this report. (CH)

For abstracts of individual sections see: 613–622, 644, 645, 649, 665–667, 1001, 1010, 1014, 1015, and 2541.

613 (NVO-153, pp 1-26) SOILS ELEMENT ACTIVITIES FOR THE PERIOD OCTOBER 1973–SEPTEMBER 1974. Fowler, E. B.; Essington, E. H. (Los Alamos Scientific Lab., NM). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Soils Element activities were conducted on behalf of the U. S. Atomic Energy Commission's Nevada Applied Ecology Group (NAEG) program to provide source term information for the other program elements and maintain continuous cognizance of program requirements for sampling, sample preparation, and analysis. Activities included presentation of papers; participation in workshops; analysis of soil, vegetation, and animal tissue samples for ^{238}Pu, $^{239-240}Pu$, ^{241}Am, ^{137}Cs, ^{60}Co, and gamma scan for routine and laboratory quality control purposes; preparation and analysis of animal tissue samples for NAEG laboratory certification; studies on a number of analytical, sample preparation, and sample collection procedures; and contributions to the evaluation of procedures for calculation of specialized counting statistics. (auth)

614 (NVO-153, pp 43-87) $^{239-240}Pu$ AND ^{241}Am CONTAMINATION OF VEGETATION IN AGED PLUTONIUM FALLOUT AREAS. Romney, E. M.; Wallace, A.; Gilbert, R. O.; Kinnear, J. E. (Univ. of California, Los Angeles). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Data are presented on the $^{239-240}Pu$ and ^{241}Am contents of vegetation samples collected in aged plutonium fallout areas on the Nevada Test Site (NTS) and the Tonopah Test Range (TTR). Preliminary data indicate definite variations in contamination levels from sample to sample collected within a given activity stratum. Variations also occur in contamination levels on different plant species which can be attributed to differences in amounts of resuspendable particulate material superficially entrapped upon plant foliage. In spite of these variations, there were some indications of reasonable agreement between the mean activity levels of $^{239-240}Pu$ in vegetation and soil samples collected across the different activity strata within each fallout area. (CH)

615 (NVO-153, pp 89-95) RADIATION DOSES AND POSSIBLE RADIATION EFFECTS OF LOW-LEVEL, CHRONIC RADIATION IN VEGETATION. Rhoads, W. A.; Franks, L. A. (EG and G, Inc., Goleta, CA). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Measurements were made of radiation doses in soil and vegetation in Pu-contaminated areas at the Nevada Test Site with the objective of investigating low-level, low-energy gamma radiation (with some beta radiation) effects at the cytological or morphological level in native shrubs. In this preliminary investigation, the exposure doses to shrubs at the approximate height of stem apical meristems were estimated from 35 to 140 R for a ten-year period. The gamma exposure dose estimated for the same period was 20.7 percent +– 6.4 percent of that recorded by the dosimeters used in several kinds of field instrument surveys. Hence, a survey instrument reading made at about 25 cm in the tops of shrubs should indicate about $\frac{1}{5}$ the dosimeter-measured exposures. No cytology has yet been undertaken because of the drought since last winter. (auth)

616 (NVO-153, pp 197-203) RESUSPENSION ELEMENT STATUS REPORT. Phelps, P. L.; Anspaugh, L. R. (Univ of California, Livermore). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Extensive field studies have been conducted at the GMX area of Nevada Test Site (NTS) with the goal of developing a parameterization of the variables related to resuspension of plutonium and other contaminants. The historical resuspension factor approach has been extended by development of a time-dependent resuspension factor model which more accurately describes resuspension of ^{239}Pu and ^{240}Pu from aged sources. The most significant progress, however, has been the synthesis of soil erosion studies, dust flux measurements, and resuspended plutonium concentration measurements into an integrated approach which also uses Healy's model of atmospheric transport and diffusion. The results are very encouraging and this new approach may lead to a general resuspension model that is site-independent. Current efforts are directed at characterizing resuspension under a wider variety of meteorological conditions and at refining the relationship between vertical dust flux and soil erodibility index. (auth)

617 (NVO-153, pp 207-215) RESUSPENSION: NEW RESULTS IN PREDICTING THE VERTICAL DUST FLUX. Shinn, J. H.; Anspaugh, L. R. (Univ. of California, Livermore). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

To properly assess the respirable health hazard from resuspended particulates, such as plutonium on host soil particles, one must consider the variables defining the vertical flux of dust. Recent experimental evidence has shown two important new facts. First, the flux of dust is much more sensitive to wind speed than previously thought, being proportional to wind speed raised to a power which is as high as 7 or 8 on highly erodible sites. Second, parameterization of the dust flux calculation is possible to reduce the number of variables required. For much of the western United States, during dry conditions, there is promise that the only independent variables necessary are the wind speed and the Soil Erodibility Index based upon soil particle size class. (auth)

618 (NVO-153, pp 217-230) DISCUSSION OF NAEG DISTRIBUTION AND INVENTORY PROGRAM SAMPLING DATA IN PREPARATION FOR INITIATION OF PHASE III. Brady, D. N. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV); Church, B. W. Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Soil sampling activities during 1974 were concentrated in Area 5 of the Nevada Test Site (NTS). Area 5 has been assigned the highest priority because of the number of atmospheric test events held and a wide distribution of contaminants. Improved sampling techniques are described. Preliminary data analysis aided in designing a program to infer $^{239-240}$Pu results by Ge(Li) scanning techniques. (auth)

619 (NVO-153, pp 231-236) DIFFERENT LOOK AT AREA 13 FIDLER SURVEY DATA. Church, B. W. (USAEC, Las Vegas, NV); Medling, E. S.; Brady, D. N. Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

FIDLER scintillation counter (field instrument for detection of low-energy radiation) data corresponding to soil samples analyzed for ^{239}Pu was evaluated for all isopleths of Area 13 of the Nevada Test Site. It was found that when considering data for the total area, a function can be derived predicting surface ^{239}Pu concentrations approximately within a factor of 2. (auth)

620 (NVO-153, pp 237-250) PLUTONIUM DISTRIBUTION IN THE ENVIRONS OF THE NEVADA TEST SITE: STATUS REPORT. Bliss, W. A.; Jakubowski, F. M. (National Environmental Research Center, Las Vegas, NV). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

In September 1970, the National Environmental Research Center-Las Vegas began a study to define the distribution of plutonium in the environment surrounding the Nevada Test Site (NTS). As a part of this study, off-NTS air and soil are being investigated for plutonium content. Air sample analyses have been limited to filters collected at selected Air Surveillance Network Stations over a period from 1966 to 1973. Soil samples have been collected in close proximity to the NTS. Extensive soil sampling has been conducted downwind from the NTS in accordance with old atmospheric fallout patterns. (auth)

621 (NVO-153, pp 251-337) FEASIBILITY AND ALTERNATE PROCEDURES FOR DECONTAMINATION AND POST-TREATMENT MANAGEMENT OF Pu-CONTAMINATED AREAS IN NEVADA. Wallace, A.; Romney, E. M. (Univ. of California, Los Angeles). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

The feasibility and environmental impact of cleaning up Pu-contaminated areas in Nevada are discussed. Findings from pertinent land area decontamination and postmanagement experiences which can be applied to solving Pu problems at the Nevada Test Site and the Tonopah Test Range are reviewed. Previous experiences from accidental and planned releases of Pu in the environment are discussed along with those gained from nuclear fallout decontamination studies. Problems concerning revegetation of arid lands are discussed. It is pointed out that the fragile nature of the desert is such that any drastic alteration will result in a seriously damaged ecosystem. Revegetation by natural means is difficult, if not impossible, from a practical point of view. Post-treatment management of disturbed areas is almost always necessary to ensure recovery. Correction of the damage may require greater efforts than the decontamination, and may have more far-reaching consequences than those concerned with the present status of the land. (CH)

622 (NVO-153, pp 339-448) STATISTICAL ANALYSIS OF $^{239-240}$Pu AND ^{241}Am CONTAMINATION OF SOIL AND VEGETATION ON NAEG STUDY SITES. Gilbert, R. O. (Battelle Memorial Inst., Richland, WA); Eberhardt, L. L.; Fowler, E. B.; Romney, E. M.; Essington, E. H.; Kinnear, J. E. Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Reported here are results of the statistical design and analysis work conducted during Calendar Year 1974 for the Nevada Applied Ecology Group (NAEG) at plutonium study sites on the Nevada Test Site (NTS) and the Tonopah Test Range (TTR). Estimates of $^{239-240}$Pu inventory in surface soil (0 to 5-cm depth) are given for each of the NAEG intensive study sites, together with activity maps based on FIDLER surveys showing the field areas to which these estimates apply. There is evidence of a preliminary nature to suggest that the plutonium present in surface soil may be covered by a thin (less than 2.5 cm) layer of soil whose alpha activity is considerably less than that directly below. Computer-drawn $^{239-240}$Pu concentration contours and three-dimensional surfaces in soil and vegetation are given for Area 13 and GMX as a first attempt at estimating the geographical distribution of $^{239-240}$Pu at these sites. (CH)

623 (ORNL-tr-2950) PLANT BIOINDICATORS OF WATER-CHANNEL CONTAMINATION DUE TO A NUCLEAR (PWR) POWER PLANT EFFLUENT. Kirchman, R.; Lambion, J. Translated by E. G. Silver from Bull. Soc. R. Bot. Belg.; 106: 187-201(1973). 17p. Dep. NTIS $4.50.

In the outline of a general program of environmental surveillance around nuclear power stations, several aquatic and ripicolous plants were checked as possible bioindicators of water contamination and of its variations during the course of time. The data-collecting network for surveillance was set up with the purpose of determining the environmental dispersion of radioactive liquid effluents. The comparison of different plant species emphasizes the difficulties of the use of helophytes; it leads to the choice of aquatic mosses, particularly Cinclidotus tambicus, as biological indicators. Response of this species at a point situated at about 15 km downstream of the nuclear power station was analyzed during a period larger than three years. At last, the contamination levels of this indicator at some points of the stream of the river Meuse are compared at an interval of two years; results are discussed, specially in connection with the activity levels of the releases. (auth)

624 (PB-238892) PREDICTION OF RADIOISOTOPE CONCENTRATIONS IN FRESHWATER STREAMS. Research Report, 1 January-31 December 1974. Seelye, J. G.; Kevern, N. R. (Michigan State Univ., East Lansing (USA). Inst. of Water Research). Dec 1974. Contract DI-14-31-0001-4022. 113p. NTIS $5.25.

Predictions of radioisotope concentrations in components of aquatic systems have been attempted using the specific activity concept, an approach that seems theoretically sound. A comprehensive examination of the specific activities of ^{134}Cs and ^{65}Zn in the components of a freshwater system, over a 10 month period, was conducted to evaluate the specific activity hypothesis under applied conditions. This study was designed to provide comparisons of predicted and observed specific activities and to test the equivalence of specific activities between all components of the system. Four ponds were used. A prediction of specific activities was made using Pond 1 data. The distribution of stable Cs and Zn throughout the system was determined and predictions of specific activities, based on these distributions were made. The other three ponds served as controls or provided observed specific activities. Radioisotopes of Cs and Zn were added to the system and after a period of equilibration comparisons were made between predicted and observed specific activities in the water, zooplankton, fish, plants, and sediment. (GRA)

625 (UCLA-12-1010) ^{239}Pu, ^{240}Pu, AND ^{241}Am CONTAMINATION OF VEGETATION IN AGED FALLOUT AREAS. Romney, E. M.; Wallace, A.; Gilbert, R. O.; Kinnear, J. E. (California Univ., Los Angeles (USA). Lab. of Nuclear Medicine and Radiation Biology). 1975. Contract E(04-1)-Gen-12. 20p. (CONF-751105-2). Dep. NTIS $4.00.

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, California, USA (17 Nov 1975).

Vegetation studies in aged plutonium fallout areas at the Nevada Test Site and Tonopah Test Range showed variations in the $^{239-240}$Pu and ^{241}Am contamination levels attributable to differences in the amounts of resuspendable particulate material superficially entrapped upon plant foliage. There was reasonable agreement between the mean activity levels in vegetation and soil samples collected across different activity strata defined by FIDLER survey instrument within each fallout area. The ratio of vegetation Pu to soil Pu tended to increase moving out from higher to lower activity strata, which might reflect the increasing proportion of finer particulate material initially deposited in fallout debris at greater distance from ground zero. The Pu/Am ratio was reasonably constant for vegetation samples collected from a given fallout area. This ratio, however, varied among separate test events primarily as the result of differences in the ingrowth of ^{241}Am within the aged source materials. Inventory estimates indicate that standing vegetation contributes a rather insignificant portion of the total contaminant remaining in these aged fallout areas. (auth)

626 (UCRL-76725) PLUTONIUM RADIONUCLIDES IN THE GROUND WATERS AT ENIWETOK ATOLL. Noshkin, V. E.; Wong, K. M.; Marsh, K.; Eagle, R.; Holladay, G.; Buddemeier, R. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Oct 1975. 35p. (CONF-751105-5; SM-199/33). Dep. NTIS $5.00.

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, California, USA (17 Nov 1975).

In 1974 a groundwater program was initiated at Eniwetok Atoll to study systematically the hydrology and the ground water geochemistry on selected islands of the Atoll. The program provides chemical and radiochemical data for assessment of water quality on those islands designated for rehabilitation. These and other data are used to interpret the mechanisms by which radionuclides are cycled in the soil-groundwater system. Because of the international concern over the long-term buildup, availability, and transport of plutonium in the environment, this program emphasizes analysis of the element. The results of the study show that on all islands sampled, small quantities of plutonium radionuclides have migrated through the soil columns and are redistributed throughout the groundwater reservoirs. The observed maximum surface concentrations are less than 0.02 percent of the maximal recommended concentration for drinking water. Concentrations of ^{137}Cs are found to correlate with water freshness, but those of $^{239+240}Pu$ show no such relationship. The mechanisms moving $^{239+240}Pu$ through the ground water reservoirs are independent of the processes controlling the cycling of ^{137}Cs and fresh water. A reasonable linear correlation is found between mean surface-water concentrations and soil burdens. This indicates that the quantities of $^{239+240}Pu$ migrating to the groundwater surface layers are, to a first approximation, independent of the physical, chemical or biological characteristics of the islands. (auth)

627 (ZAED-BIBL.-02-15) BIBLIOGRAPHIES IN NUCLEAR SCIENCE AND TECHNOLOGY. Section 02: Contamination and Decontamination of Foods. Number 15. (Zentralstelle fuer Atomkernenergie-Dokumentation, Leopoldshafen (F.R. Germany)). Feb 1975. 31p. (In German and English). Dep. NTIS (US Sales Only) $4.75.

This bibliography contains annotated references to some 100 recent publications on food contamination by radioisotopes and decontamination procedures. (CH)

628 (ZAED-BIBL.-02-16) BIBLIOGRAPHIES IN NUCLEAR SCIENCE AND TECHNOLOGY. Section 02: Contamination and Decontamination of Foods. Number 16. Fischer, E. (comp.). (Zentralstelle fuer Atomkernenergie-Dokumentation, Leopoldshafen (F.R. Germany)). Jun 1975. 34p. (In German and English). Dep. NTIS (US Sales Only) $4.75.

This bibliography contains annotated references to some 150 published documents from the world literature on food contamination by radioisotopes and decontamination procedures. (CH)

629 COMMENTS ON THE PAPER: "USE OF RIVERS TO PREDICT ACCUMULATION IN SEDIMENT OF RADIONUCLIDES DISCHARGED FROM NUCLEAR POWER PLANTS" BY P. PLATO. Edington, D. N. (Argonne National Lab., IL); Ritchie, J. C.; Robbins, J. A. Health Phys.; 29: No. 3, 429-431(Sep 1975).

Reference is made to a paper by Plato (Health Phys.; 26: 489 (1974)) in which the source and distribution of ^{137}Cs in the bottom sediments off the eastern shore of Lake Michigan is discussed. It is stated that in his analysis Plato neglected to consider the influence of three important factors which can seriously affect the validity of his conclusions. These factors are (1) the almost impossibility of calculating the total amount of ^{137}Cs in a sediment profile from a grab sample; (2) the strong ionic bond between ^{137}Cs and clay minerals; and (3) the contribution of direct atmospheric deposition into the lake by wet or dry scavenging processes. The effect of these factors on Plato's conclusions is discussed. (UK)

Atmosphere

Refer also to abstracts 672, 681, and 1413.

630 (AECL-5178) BIOLOGY AND HEALTH PHYSICS DIVISION. Progress Report, 1 January–31 March 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). May 1975. 64p. (PR-B-105). Dep. NTIS (US Sales Only) $6.25. AECL $1.50.

Separate abstracts were prepared for the four sections of the report. (HLW)

For abstracts of individual sections see: 592, 631, 841, and 2539.

631 (AECL-5178, pp 7-24) HEALTH PHYSICS BRANCH. Cowper, G. May 1975.

In Biology and Health Physics Division. Progress Report, 1 January–31 March 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Tabulated and graphical data on neutron spectra from various fission sources are being compiled in order to estimate doses in the event of a criticality incident. Neutron leakage spectra calculations using the 05R Monte Carlo code have continued with the preparation of data for Am-Be sources in water spheres of various diameters and for H_2O- and D_2O-moderated fission neutrons transmitted through lead shields of several radii. Progress is also reported on research on thermoluminescence dosimetry, plutonium in air monitoring, radiation monitoring instruments, tritium monitoring, and ^{41}Ar detection in air. (HLW)

632 (DPSPU-75-302) ENVIRONMENTAL MONITORING AT THE SAVANNAH RIVER PLANT. Annual Report, 1974. Ashley, C.; Zeigler, C. C. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Aug 1975. Contract AT(07-2)-1. 74p. Dep. NTIS $5.50.

Results obtained from the environmental radioactivity monitoring program at the Savannah River Plant (SRP) during 1974 are summarized. A brief discussion of plant releases to the environment and radioactivity detected in the environment is presented in the following text, figures, and tables. The appendices contain tables of results from environmental samples analyses, sensitivities of laboratory analyses, and maps of sampling locations. (auth)

633 (KFK-2164) STATISTICAL EVALUATION OF MEASUREMENTS OF WIND, TEMPERATURE, AND HUMIDITY PROFILES IN RELATION TO RADIOACTIVITY OF SURFACE AIR AT KARLSRUHE NUCLEAR RESEARCH CENTER FROM 1972 TO 1974. Dilger, H.; Nester, K.; Vogt, S. (Kernforschungszentrum Karlsruhe (F.R. Germany). Abt. Strahlenschutz und Sicherheit). Jul 1975. 84p. (In German). Dep. NTIS (US Sales Only) $7.25.

A statistical evaluation is presented of measurements relating to the wind, temperature, and humidity profiles, in relation to radioactivity in the atmosphere with fluctuations of wind direction, which were performed at the 200 m meteorological tower of the Karlsruhe Nuclear Research Center from December 1, 1972 to November 30, 1974. (auth)

634 (KFK-2188) MONITORING OF RADIOACTIVE EFFLUENTS IN ATMOSPHERE AT KARLSRUHE NUCLEAR RESEARCH CENTER DURING 1974 AND 1975. Huebschmann, W.; Nagel, D.; Papadopoulos, D. (Kernforschungszentrum Karlsruhe (F.R. Germany). Abt. Strahlenschutz und Sicherheit). Jul 1975. 11p. (In German). Dep. NTIS (US Sales Only) $4.00.

The calculated radiological impact on the environment of the Karlsruhe Nuclear Research Center due to radioactive emissions to the atmosphere in the years 1974 and 1975 is presented. (auth)

635 (NP-20601) RESEARCH REPORTS OF THE NATIONAL ENVIRONMENTAL RESEARCH CENTER–LAS VEGAS, JANUARY–DECEMBER 1974. (National Environmental Research Center, Las Vegas, Nev. (USA)). 1975. 26p. National Environmental Research Center, Las Vegas, NV.

This bibliography lists reports of the National Environmental Research Center's work in five categories. Reports published in the EPA Series, listed in Section I, are available through the National Technical Information Service (NTIS) or from the Superintendent of Documents at the U.S. Government Printing Office. Those published in the NERC-LV Series, Section II, are reports of work performed for the AEC and are available through the NTIS or from the Oak Ridge Technical Information Center in Oak Ridge, Tennessee. Reports published as articles in professional journals or in proceedings of scientific and technical meetings can usually be seen in most major libraries, particularly those associated with universities. Reprints of journal articles and hard copies of papers presented at scientific and technical meetings can sometimes be obtained from the author as long as his supply lasts. Section V lists reports in a Working Paper Series for EPA's National Eutrophication Survey. These are available from the NTIS. The NERC-LV does not maintain its own mailing list for distribution of published reports. (auth)

636 (PEL-246) ENVIRONMENTAL RADIOACTIVITY AT THE NATIONAL NUCLEAR RESEARCH CENTRE, Pelindaba. Report for the Year 1974. van As, D.; Vleggaar, C. M. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Jul 1975. 19p. Dep. NTIS (US Sales Only) $4.50.

Results are reported from an environmental survey in the vicinity of the National Nuclear Research Center (NNRC) at Pelindaba, Republic of South Africa during 1970 through 1974. Emphasis was placed on monitoring the critical paths of exposure of the general public. The analytical method for ^{131}I in milk was improved to give a lower detection limit, and the gamma background survey now also includes a more specific measurement for ^{131}I. Results of determinations of both gross radioactivity and individual nuclides in samples of fish and water (which are critical materials for liquid effluent releases) from the Hartbeespoort Dam and from the Crocodile River, are given and discussed. Results of gamma-spectrometric ^{131}I and ^{90}Sr analyses of milk, the

critical material for releases to the atmosphere, are presented. Results are given of regular investigations of the composition of effluent releases which were well below the permissible levels. Levels of deposited and airborne activity from nuclear bomb tests are reported. No environmental radioactivity resulting from NNRC releases could be detected above the fallout levels. (auth)

637 (UCRL-76795) INSTRUMENTATION FOR OFF-SITE REACTOR PLUME STUDIES. Ragaini, R. C.; Jones, D. E.; Huckabay, G. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 Sep 1975. 8p. (CONF-750963-1). Dep. NTIS $4.00.

From IEEE international conference on environmental sensing and assessment; Las Vegas, Nevada, USA (15 Sep 1975).

As part of the Lawrence Livermore Laboratory program to assess the environmental impact of various types of nuclear power plants, methods are being investigated for the real-time analysis of reactor plume isotopic exposure rates. The Biomedical and Environmental Research Division mobile laboratory that was developed for terrestrial radioactivity measurements has been modified for atmospheric studies. The existing Ge(Li) spectrometer and high-pressure argon-ion chamber-detector systems have been augmented by the addition of wind speed and direction measuring capability and a second, remotely operable, ion chamber. The mobile laboratory and techniques for plume measurements are discussed. (auth)

638 (ZJE--166) METEO-1: A PROGRAMME FOR CALCULATIONS OF ATMOSPHERIC DISPERSION OF ACTIVITIES FROM NUCLEAR POWER REACTORS. Veverka, O.; Valenta, V.; Vlachovskii, K. (Skoda, Plzen (Czechoslovakia)). 1975. 30p. Dep. NTIS (US Sales Only) $4.50.

The atmospheric transport and turbulent diffusion of radioactive gaseous wastes from a nuclear power plant under various meteorological conditions were calculated for normal reactor operating conditions and reactor accidents. Formulae used in the calculations for two stack heights are included. (CH)

639 (ZJE--167) SOME COMMENTS ON THE PROBLEM OF THE ATMOSPHERIC TRANSPORT OF RADIOACTIVITIES RELEASED FROM A VENTILATION STACK OR FROM A LEAKY REACTOR BUILDING. Valenta, V.; Vlachovskii, K.; Veverka, O. (Skoda, Plzen (Czechoslovakia)). 1975. 9p. Dep. NTIS (US Sales Only) $4.00.

A formula is presented for use in calculating the atmospheric transport of radioactive gases released to the environment from the stack of a nuclear power plant or following leakage from the building. Variables considered are the stack height and meteorological conditions. (CH)

Soil

Refer also to abstract 1408.

640 EXPERIENCE IN THE APPLICATION OF GEOPHYSICAL EXPLORATION OF BOREHOLES IN THE STUDIES ON PETROPHYSICS OF INTRUSIVE ROCKS IN VORONEZH CRYSTALLINE MASSIF. Bojdachenko, V. N.; Zal'tsmanovich, I. I. Razved. Geofiz.; No. 58, 140-146(1973). (In Russian).

3 figs.; 1 table.

A presentation is given of the technique and results of investigating the electrical and radioactive properties of intrusive formations of the Voronezh crystalline massif from borehole survey data and their mutual relationship with the mineralogical composition of the ores. It is shown that it is necessary to obtain more accurate data on the petrophysical ore characteristics for each deposit site of copper-nickel sulfide ores. (auth)

641 NATURAL RADIOIODINE SORBENTS IN THE LIVING ENVIRONMENT. Benes, J. Jad. Energ.; 20: No. 9, 316-319 (Sep 1974). (In Czech).

A brief outline is presented of the rate of the ^{131}I deposition on plants, of the radioiodine retention by plants and of its clearance, of the retention and transport of radioiodine in the soils, and of the radioiodine sorption on the soils. Also discussed are the radioiodine retention in deposits and fluvial deposits and the possible applications of natural sorbents in practice. (INIS)

642 CONCENTRATION OF RADON 222, ITS SHORT-LIVED DAUGHTER PRODUCTS AND SOME OTHER ATMOSPHERIC SPURIOUS MATERIALS IN THE GROUND STRATUM AND IN THE LOWER TROPOSPHERE. Sappok, M. Heidelberg; Univ. Heidelberg (1973). 78p. (In German). INIS.

Thesis.

A report is given on the activity concentration of radon 222 and its short-lived daughter products in the first 3,000 m of the atmosphere. An apparatus has been developed which enables the simultaneous determination of the activity of radon 222, polonium 218, lead 214, and of bismuth 214 during a measuring period of 30 minutes. The determination of radon takes place by adsorption on active coal at −78°C, desorption at +450°C and counting of the decays in a scintillation chamber, while the daughter products are determined by collecting on filters and discrimination between α- and β-radiation as well as delayed coincidence between bismuth 214 and polonium 214. (GE)

Ecosystems and Food Cycles

Refer also to abstracts 665 and 1014.

643 (NTIS/PS-75/088) ECOSYSTEM MODELS (A BIBLIOGRAPHY WITH ABSTRACTS). Report for 1964–October 1974. Harrison, E. A. (National Technical Information Service, Springfield, Va. (USA)). Jan 1975. 149p. NTIS $25.00.

The bibliography contains 144 selected abstracts. It includes reports which cover marine biology, natural resources, wildlife, plants, water pollution, microorganisms, food chains, radioactive substances, freshwater and diseases as related to ecosystem models. (GRA)

644 (NVO-153, pp 137-149) SOLUBILITY OF PLUTONIUM FROM RUMEN CONTENTS OF CATTLE GRAZING ON PLUTONIUM-CONTAMINATED DESERT VEGETATION IN IN VITRO BOVINE GASTROINTESTINAL FLUIDS. Barth, J. (National Environmental Research Center, Las Vegas, NV). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Rumen contents of cattle grazing on plutonium-contaminated desert vegetation at the Nevada Test Site were incubated in simulated bovine gastrointestinal fluids to study the alimentary solubility of plutonium. Trials were run during November 1973, and during February, May, July and August 1974. During the May and July trials, a large increase in plutonium solubility accompanied by a marked reduction in plutonium concentration of the rumen contents was observed concurrently with a reduction in intake of Eurotia lanata and an increase in the intake of Oryzopsis hymenoides or Sitanion jubatum. However, during the November, February, and August trials, comparatively high concentration of plutonium, but low plutonium solubility, was associated with high levels of Eurotia lanata in the rumen contents. Plutonium-238 was generally more soluble than plutonium-239 in these fluids. Ratios of the percentage of soluble plutonium-238 to the percentage of soluble plutonium-239 varied from 1 : 1 to 18 : 1 on a radioactivity basis. (auth)

645 (NVO-153, pp 151-185) ECOLOGICAL STUDIES OF SMALL VERTEBRATES IN Pu-CONTAMINATED STUDY AREAS OF NTS AND TTR. Bradley, W. G.; Moor, K. S. (Univ. of Nevada, Las Vegas). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Ecological studies of vertebrates in plutonium-contaminated areas of the Nevada Test Site (NTS) were initiated in March 1972, and have continued to date. In September 1973, standard census methods were also employed to derive a qualitative and quantitative inventory of vertebrate biota of four Nevada Applied Ecology Group (NAEG) study areas of the Tonopah Test Range (TTR). A checklist of vertebrates of NAEG study areas of NTS and TTR is presented. Data are presented on vertebrate composition, relative abundance, and seasonal status in the study areas. Concentrations of ^{239}Pu and ^{241}Am were determined in pelt or skin, GI tract, and carcass of 13 lizards and 16 mammals resident on Clean Slate 2, TTR, and Area 11, NTS. A total of 71 animals were collected for radioanalysis. However, the data were not available at the time this report was written. Pu tissue burdens were highest in lizards from Area 11 GZ. Maximum values obtained in nCi/g ash were 30.9, 42.2, and 0.43 for the pelt, GI tract, and carcass, respectively. Maximum ^{239}Pu values in tissues of small rodents from Area 11 (not from GZ) were 11.4, 6.49, and 0.20 nCi/g ash for pelt, GI tract, and carcass, respectively. Pu/Am ratios were relatively consistent in tissue samples of lizards and small mammals from Area 11 (approximately 6 : 1, Pu/Am). Pu/Am ratios were not consistent in vertebrates of Clean Slate 2, TTR, and appeared to be lower in carcass (28 : 1, Pu/Am in mammals) than GI tract (9 : 1, Pu/Am in mammals). Although this trend was more conspicuous in mammals, it was also evident in reptiles. (auth)

646 (PRNC-189) PUNTA VERRACO ENVIRONMENTAL STUDIES. Wood, E. D.; Youngbluth, M. J.; Yoshioka, P.; Canoy,

M. (Puerto Rico Nuclear Center, Mayaguez). 1 Jun 1975. Contract E(40-1)-1833. 111p. Dep. NTIS $6.50.

For Puerto Rico Water Resources Authority, San Juan.

The Puerto Rico Nuclear Center of the University of Puerto Rico has been under contract to the Puerto Rico Water Resources Authority since 1972 to conduct site selection surveys and environmental research studies of seven coastal sites. Experience gained from these investigations will add to the knowledge about these areas, and provide useful data which will aid in the assessment of the desirability and practicability of locating power generating plants on one or more of these sites. Data are presented on the physical, chemical, and geological parameters of the Punta Verraco site, including ecological parameters of zooplankton, benthic invertebrate and fish communities, and plant associations. (CH)

647 STOCHASTIC STATISTICAL CHARACTERISTICS OF RADIONUCLIDE ACCUMULATION BY FRESHWATER PLANTS. Piskunov, R. I.; Popov, B. V. (AN SSSR. Sverdlovsk. Inst. Ekologii Rastenij i Zhivotnykh). Ekologiya; No. 3, 90-93(May 1974). (In Russian).

For English translation see the journal Ecology.

As a result of an analysis that is carried out the available information is generalized on the distribution coefficients of the main radionuclides in freshwater plants in the form of statistical probability characteristics. The regularities in the distribution coefficients are more accurately defined, and plants having anomalous features in nuclide distribution are more readily isolated. The data are suitable for use in perfecting radioecological methods and for radiation control in surface reservoirs, in particular, at atomic reactor sites. (INIS)

Radiometric Techniques

Refer also to abstracts 7, 596, 610, 613, 618, 619, 645, 665–667, 782, 783, 788, 793, and 1001.

648 (COM-74-50079) EVALUATION OF RADIOCARBON MEASUREMENTS AND INHERENT STATISTICAL LIMITATIONS IN AGE RESOLUTION. Final Report. Currie, L. A. (National Bureau of Standards, Washington, D.C. (USA)). 1973. 14p. (CONF-721019-2).

From international radiocarbon dating conference; Wellington, New Zealand (18 Oct 1972).

A uniform approach, based upon the statistical behavior of random measurement errors, is suggested for assessing the relative merit of alternative methods of measuring radiocarbon and for interpreting and reporting the results of such measurements. The need for an objective, uniform approach is manifest because of the increasing concern with results which are close to the limits of precision or detection of the dating procedures. (GRA)

649 (NVO-153, pp 473-490) DETERMINATION OF ^{241}Am IN SOIL USING AN AUTOMATED NUCLEAR RADIATION MEASUREMENT LABORATORY. Engstrom, D. E. (Reynolds Electrical and Engineering Co., Inc., Mercury, NV). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

The recent completion of REECo's Automated Laboratory and associated software systems has provided a significant increase in capability while reducing manpower requirements. The system is designed to perform gamma spectrum analyses on the large numbers of samples required by the current Nevada Applied Ecology Group (NAEG) and Plutonium Distribution Inventory Program (PDIP) soil sampling programs while maintaining sufficient sensitivities as defined by earlier investigations of the same type. The hardware and systems are generally described in this paper, with emphasis being placed on spectrum reduction and the calibration procedures used for soil samples. (auth)

650 FISSION TRACK DATING. Khan, H. A. (Pakistan Atomic Energy Commission, Karachi). Nucleus (Karachi).; 11: No. 3, 53-63(Jul 1974).

20 refs.

A descriptive account is presented of the use of the fission track technique for dating and determining uranium content. Basic equations are introduced and the necessary track parameters described in detail. Special emphasis has been laid on the annealing of tracks and the information which can be obtained about the thermal histories of the samples. (INIS)

651 THE GAMMA-GAMMA LOG PROGRAM AND ITS USE IN STUDYING THE POTENTIALITIES OF THE TWO-BEAM DENSITY GAMMA-GAMMA LOGGING. Khisamutdinov, A. I. (Bashkirskij Gosudarstvennyj Univ., Ufa (USSR)). No. 56(1) p. 299-311 of Monte Carlo Methods in Physics and Geophysics. Proceedings of Bashkirian State Univ. Ufa; Bashkirskij Gosudarstvennyj Univ. (1973). (In Russian)

8 refs.; 2 figs.; 4 tables.

The GGK program for solving, by the Monte Carlo method, certain problems related to gamma-gamma logging is described. On an electronic digital computer it imitates to some degree the analog trajectories of gamma quanta under gamma-gamma logging conditions and functionals are calculated as averages of these trajectories. The program is described in computer codes M-20 and M-220. (tr-auth)

652 THE PROSPECTS OF USING NUCLEAR-MAGNETIC WELL LOGGING AT UZEN' FIELD. Aksel'rod, S. M.; Asmolov, V. S.; Bulanova, V. A.; Vaganov, N. I.; Danevich, V. I.; Nadiev, Z. N.; Sadykhov, D. M.; Sokolov, V. B. Azerb. Neft. Khoz.; No. 4, 7-8, 45(1973). (In Russian).

2 figs.; 1 table.

Nuclear-magnetic logging (NML) data, obtained in boreholes of the Uzen' deposits (Mangyshlak district) are examined. Analysis of NML diagrams shows that they readily differentiate sections and characterize nonuniformity in porosity of stratum-collector structure. The characteristics of NML curves are maintained on all surfaces. This makes it possible to use them for correlating borehole sections. From the differences in porosity it is possible to estimate the thickness of a stratum. The nonuniformity of a collector and the relation between porosity and penetrability make the use of NML promising for predicting industrial interest in a site. (tr-auth)

653 PRIMENENIE YADERNYKH IZLUCHENIJ V GEOFIZICHESKIKH ISSLEDOVANIYAKH. (Application of Nuclear Radiations in Geophysical Exploration). Novosibirsk; Institut Geologii i Geofiziki Sibirskogo Otdeleniya AN SSSR (1973). 248p. (In Russian).

Nuclear geophysical methods are classified. A number of articles discuss neutron-resonance logging for boron and methods and interpretation of data with a computer. Results of Monte Carlo calculations and of experiments on neutron-resonance logging determination of boron in rocks on flat surfaces are presented. Results of studies on polymetal ores in boreholes, data on determination of nitrogen in models of petroleum strata, and studies on characteristic density measurements on investigations on mining and angular boreholes are discussed. A small-scale microtron (4 MeV energy, 1 μA average current) with its individual blocks and electronics, and a pulsed method for determining beryllium in samples are described. A new determination of the sensitivity threshold of nuclear geophysics methods is given. Problems of neutron activation analysis of stratal water and other problems are discussed. (tr-auth)

654 INVESTIGATION OF THE RADIOACTIVITY AND EMANATION PROPERTIES OF DEVONIAN SEDIMENTS IN VOLGOGRAD POVOLZH'E. Belousova, M. G.; Ermakov, A. M.; Makarov, M. S.; Dianova, I. M. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Neftyanoj Promyshlennosti, Volgograd (USSR)). No. 19 p. 62-68 of Improvements of Geochemical and Geophysical Methods of Oil and Gas Exploring in Volgograd Povolzh'e. Proceedings of Volgograd NIPINeft'. Volgograd; Nizhne-Volzhskoe Knizhnoe Izdatel'stvo (1973). (In Russian)

4 refs.; 2 figs.; 3 tables.

Data on the gamma activity of rocks of different compositions and age and emanations from them are presented. A marked increase in radioactivity with increase in the amount of clay in samples was noted, which permits evaluating the amount of clay present by a gamma method. (tr-auth)

655 CALCULATION OF GAMMA-GAMMA LOG DATA DEPENDENCE UPON THE ROCK DENSITY AND MUD CAKE THICKNESS FOR PROBES UP TO 1 METER BY MONTE-CARLO METHOD. Gulin, Yu. A.; Velizhanin, V. A.; Dyad'kin, I. G. pp 221-224 of Monte-Carlo Methods in Computer Mathematics and Mathematical Physics. AN SSSR, Novosibirsk. Sibirskoe Otdelenie. Novosibirsk; AN SSSR, Sibirskoe Otdelenie (1974). (In Russian)

3 refs.; 1 fig.

Results are presented of a Monte Carlo calculation of the dependence of the gamma-gamma log on rock density and mud cake thickness for 1-meter probes. The calculation was made for a ^{60}Co source (two lines, 1.7 and 1.37 MeV) on a BESM-4 target. The effect of the mud cake may be neglected only for zones of about 90 cm. The probability of recording is of the order of 10^{-9}. In small zones (about 40 cm) a 3-cm mudcake has a more significant effect than a change in porosity of the rock from 0 to 40%. (INIS)

656 INVESTIGATION OF NEUTRON-GAMMA LOG DATA DEPENDENCE ON HYDROGEN CONCENTRATIONS IN ROCKS BY MONTE CARLO METHOD. Gulin, Yu. A.; Dvorkin, I. L.; Starikov, V. N. (Bashkirskij Gosudarstvennyj Univ., Ufa (USSR)). No. 56(1) p. 291-298 of Monte Carlo Methods in Physics and Geophysics. Proceedings of Bashkirian State Univ. Ufa; Bashkirskij Gosudatstvennyj Univ. (1973). (In Russian)

2 refs.; 4 figs.

Results are given of calculations of neutron-gamma log data dependence on the limestone porosity with consideration of the effect of liquid filling the shaft apertures, and equipment diameter. First were calculated data on effects of contributions due to radiation capture of neutrons in the opening and stratum on the results were first calculated. (tr-auth)

657 ON THE INFLUENCE OF NATURAL GAMMA RADIATION SPECTRUM ON THE RESULTS OF LABORATORY AND WELL MEASUREMENTS OF RADIOACTIVITY OF ROCKS WITH A HIGH POTASSIUM CONCENTRATION. Gulin, Yu. A.; Starikov, V. N.; Enikeeva, F. Kh. (Bashkirskij Gosudarstvennyj Univ., Ufa (USSR)). No. 56(1) p. 312-322 of Monte Carlo Methods in Physics and Geophysics. Proceedings of Bashkirian State Univ. Ufa; Bashkirskij Gosudarstvennyj Univ. (1973). (In Russian)

6 refs.; 5 figs.; 3 tables.

Calculations showed that when using laboratory scintillation detectors with "wells" having a small wall thickness the potassium contribution is 1.5- to 2-fold less than that of U-Ra and Th per radiation quantum. With laboratory counters the potassium contribution was overestimated about 2-fold. For quantitative determination of the effect, calculations were made by the Monte Carlo method. From the results can be obtained the ratio of the potassium contributions, the U-Ra, and Th in the indexes recorded by a different type of indicator. Comparison of data calculated under laboratory and borehole conditions showed the inaccuracy of applying laboratory data to interpretation of diagrams from sections with high potassium content without consideration of the spectral properties of the equipment and the borehole apparatus. Combinations of laboratory and borehole equipment were selected with which results were compared. (INIS)

658 SPECIAL FEATURES OF INTERPRETATIONS OF DATA FROM COMMERCIAL GEOPHYSICAL INVESTIGATIONS IN THE WELLS, BORED IN OLD AREAS (FROM DATA OF AL'MET'EV GEOPHYSICAL EXPLORATION OFFICE). Khairetdinov, R. Sh.; Nikolaeva, K. P. (Kazanskij Gosudarstvennyj Univ. (USSR)). pp 174-181 of Oil-Exploration Geophysical Investigations at the Territory of Tataria. Kazan'; Kazanskij Gosudarstvennyj Universitet (1974). (In Russian)

3 refs.; 2 figs.

Results are presented from the use of combinations of geophysical methods, both electrical and radioactive, in studying boreholes to determine the nature of stratum saturation. The combinations used were not satisfactory with deep absorption by petroleum layers of fresh filtrate or of demineralized water. (tr-auth)

659 HYDROGEOLOGICAL POSSIBILITIES OF APPLYING SHORT-TERM TRITIUM STUDIES ON GROUND-WATER FROM JOINTED POROUS AND JOINTED CAVERNOUS GROUND-WATER AQUIFER TYPES. Milde, G.; Klinger, Ch.; Froehlich, K. (Bergakademie Freiberg (German Democratic Republic). Sektion Geowissenschaften; Bergakademie Freiberg (German Democratic Republic). Sektion Physik). Z. Angew. Geol.; 20: No. 4, 159-163(1974). (In German).

Tritium investigations are applied to hydrogenetic problems. Some examples are mentioned. (INIS)

660 MAPPING OF ROCK HYDROTHERMAL CHANGE ZONES BY GAMMA-SPECTROMETRIC METHOD. Semenov, P. V.; Fel'dman, A. A. No. 109 p. 6-11 of Transactions of Tsentral'nyi Nauchno-Issledovatel'skii Geologorazvedochnyj Inst. Tsvetnykh Redkikh i Blagorodnykh Metallov. Moscow: Nedra (1973). (In Russian)

2 refs.

Gamma spectrometry was used in combination with spectrometric survey measurements for large-scale mapping of hydrothermal changes in rocks in connection with a search for gold-bearing deposits of the near-surface type in volcanic regions of the Far East. (tr-auth)

661 METHODICAL AND MEASURING RESULTS OF USING TRITIUM, ^{14}C, AND ^{32}Si DETERMINATIONS FOR HYDROGEOLOGICAL PROBLEMS. Froehlich, K.; Milde, G.; Hebert, D.; Kater, R. (Bergakademie Freiberg (German Democratic Republic). Sektion Geowissenschaften; Bergakademie Freiberg (German Democratic Republic). Sektion Physik). Z. Angew. Geol.; 20: No. 1, 16-21(1974). (In German).

Some measuring results serve to show that in ground water dating the possibilities of applying the radionuclide tritium present in water are mainly suited for determining the age of juvenile water, for demonstrating water older than 50 years, and for the qualitative demonstration of mixed water. By measuring ^{14}C and ^{32}Si simultaneously with tritium the age of the ground water can be determined quantitatively between 0 and about 40,000 years, as can possible portions of juvenile water. A model suited for evaluating such measurements is described, and an account is given of some problems of measurement connected with a complex application of these radionuclides. Measuring devices developed for carrying out such investigations are briefly reviewed. (INIS)

662 THE USE OF ^{51}Cr-EDTA FOR THE DETERMINATION OF THE HYDRAULIC CONDUCTIVITY OF SOIL AND THE RATE OF FLOW OF GROUND WATER AT THE VAALHARTS GOVERNMENT IRRIGATION SCHEME. Van der Westhuizen, M.; Van der Bank, D. J. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Physics Div.); Streutker, A. (Soil and Irrigation Research Inst., Pretoria (South Africa)). Agrochemophysica.; 5: 67-70(1973). (In Afrikaans).

The radioactive tracer ^{51}Cr-EDTA was used in two experiments to determine the hydraulic conductivity, K, and the rate of flow, v, of ground water at a plot on the Vaalharts Government Irrigation Scheme. A number of holes were drilled on the plot and it was found that the water table was at a depth of about two metres. In the first experiment an artificial gradient of the water table of 40 cm per 100 cm was maintained by pumping, and values of K = 23.7 cm/h and v = 23.3 cm/h were obtained. In the second experiment use was made of the natural gradient of the water table which was 2.1 cm per 100 cm, and values of K = 29.7 cm/h and v = 1.49 cm/h were obtained. The values compare favorably with those obtained by other methods. (INIS)

663 DISCUSSION ON THE RELATIVE MERITS OF $^{40}Ar/^{39}Ar$ AND CONVENTIONAL K-Ar DATING TECHNIQUES. Baksi, A. K. (Carleton Univ., Ottawa). Geophys. Res. Bull.; 12: No. 1, 75-81(Jan 1974).

Site Surveys

Refer also to abstracts 593, 595, 603, 610, 612, 614, 615, 618, 619, 621, 622, 625, 632, 645, 646, 674, and 899.

664 (BNWL-1916) CHARACTERIZATION OF PLANT COMMUNITIES ADJACENT TO THE B-C CRIBS CONTROLLED AREA AND REDOX POND AREAS ON THE 200 AREA PLATEAU. Cline, J. F.; Uresk, D. W.; Rickard, W. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jan 1975. Contract AT(45-1)-2130. 59p. Dep. NTIS $4.00.

The plant communities at the Hanford B-C Cribs controlled area and REDOX study areas are characterized. It is concluded that they are probably very much like the communities that existed prior to 1943 when the Hanford Reservation was established. (CH)

665 (NVO-153, pp 27-41) CHARACTERIZATION OF PLUTONIUM IN SURFACE SOILS FROM AREA 13 OF THE NEVADA TEST SITE. Tamura, T. (Oak Ridge National Lab., TN). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Total plutonium was determined in nine surface soil samples (0 to 5 cm) from Area 13 in the Nevada Test Site (NTS). Particle size segregation was performed, and each particle size fraction of seven samples was analyzed for plutonium. The coarse silt fraction [53 to 20 micrometers (mu m)] contained the highest percentage of plutonium in the soil (about 65 percent). Evidence of erosional translocation of plutonium was observed in one sample and corroborative evidence was noted in describing the soil type. Tests with 8 molar (M) nitric acid showed that about 13 percent of the plutonium was leached from the NTS sample, about 70 percent from sediments at Oak Ridge, and about 83 percent from sediments at Mound Laboratory. In 0.1 M citric acid, about 1 percent of the plutonium was extracted from an NTS sample, 25 percent from Oak Ridge samples, and 44 percent from Mound. Implications of these results on transport of plutonium within the NTS are discussed. (auth)

666 (NVO-153, pp 465-469) REECo ACTIVITIES AND SAMPLE LOGISTICS IN SUPPORT OF THE NEVADA APPLIED ECOLOGY GROUP. Wireman, D. L.; Rosenberry, C. E. Jr. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Activities and sample logistics of Reynolds Electrical and Engineering Co., Inc. (REECo), in support of the Nevada Applied Ecology Group (NAEG), are discussed in this summary report. Activities include the collection, preparation, and shipment of samples of soils, vegetation, and small animals collected at Pu-contaminated areas of the Nevada Test Site and Tonopah Test Range. (CH)

667 (NVO-153, pp 471-472) ENVIRONMENTAL SCIENCES INFORMATION STORAGE AND RETRIEVAL SYSTEM. Engstrom, D. E. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Reynolds Electrical and Engineering Co., Inc. (REECo), has since 1970 accumulated information relating to the AEC's Nevada Applied Ecology Group (NAEG) programs at the Nevada Test Site (NTS). These programs, involving extensive soil, vegetation, and small-animal studies, have generated informational data concerning the collecting, processing, analyzing, and shipping of sample materials to various program participants and contractors. Future plans include incorporation of Lawrence Livermore Laboratory's resuspension study data, REECo's on-site air data, and EPA's large-animal, off-site air, and off-site soil data. (auth)

Thermal Effluents

Refer also to abstracts 592 and 672.

668 (PB-238375) RELATIONSHIP OF ELECTRIC POWER STATION THERMAL CIRCULATION TO BIOLOGICAL PRODUCTIVITY OF RESERVOIRS. Research Project Completion Report. Lind, O. T.; Venables, B. J.; Wysong, M.; Lukins, D. L. (Baylor Univ., Waco, Tex. (USA)). Jan 1974. Contract DI-14-31-0001-3339. 114p. NTIS $5.25.

Phytoplankton photosynthesis was measured May 1971–July 1972. Three depths at both the cool intake and warmed discharge of a steam electric station were sampled. Thermal circulation produced no measured negative effects at temperatures below 40C. Photosynthetic carbon uptake was significantly greater in samples collected from and incubated at the warmed discharge than samples from either site and incubated at the cooler intake. At temperatures greater than 40C, a significant depression in photosynthesis occurred. There was no significant effect on growth, reproduction, or metabolism of the largemouth bass (Micropterus salmoides). The Ostracode (Cypridopsis vidua) from the warmed discharge actively avoided temperatures greater than 30C. Mean oxygen consumption rate was positively linearly correlated with increasing temperatures (15-35C). Mean carbon dioxide production was high and was positively linearly correlated with temperature to 30C. Reduction of the ingestion rate above 30C was significant. (GRA)

669 (PB-239073) THERMAL REQUIREMENTS AND TOLERANCES OF KEY ESTUARINE ORGANISMS. Mihursky, J. A.; Kennedy, V. S.; McErlean, A. J.; Roosenburg, W. H.; Gatz, A. J. (Maryland Univ., College Park (USA). Water Resources Research Center). 1974. Contract DI-14-31-0001-3020. 153p. NTIS $6.25.

The contents of the report include: Regional planning and the Chesapeake Bay environment–an ecological approach; Upper temperature tolerances of some estuarine bivalves; Effects of temperature on the respiratory metabolism of three Chesapeake Bay bivalves; Effects of temperature on activity and mortality of the Scyphozoan Medusa, Chrysaora quinquecirrha; Abundance, diversity, and seasonal patterns of estuarine fish populations; Temperature-time relationships for survival of embryos and larvae of Mulinia lateralis (Mollusca:Bivalvia); Mercenaria merceneria (Mollusca: Bivalvia)–Temperature-time relationships for survival of embryos and larvae; effects of thermal shock on activity rhythms in the hogchoker, Trinectes maculatus; Osmotic response of the Blue crab, Callinectes sapidus, to temperature and salinity stress. (GRA)

670 (UCRL-77222) ANTHROPOGENIC MOISTURE PRODUCTION AND ITS EFFECT ON BOUNDARY LAYER CIRCULATIONS OVER NEW YORK CITY. Bornstein, R. D.; Tam, Y. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1975. 50p. (CONF-750854-1). Dep. NTIS $5.50.

From conference on the urban physical environment; Syracuse, New York, USA (25 Aug 1975).

The heat and moisture excess over New York City is shown to exist by the analysis of helicopter soundings of temperature and wet bulb depression. The magnitude of the temporal and spatial distribution of anthropogenic moisture emissions in New York City were estimated from fuel usage data. The URBMET urban boundary layer model was used to evaluate the effects on the dynamics of the urban boundary layer resulting from the observed urban moisture excess. Work is currently in progress which seeks to determine the fraction of the observed moisture excess over New York that is due to anthropogenic sources. (auth)

Chemical Effluents

Refer also to abstracts 103, 595, and 604.

671 (AED-CONF-73-562-002) NUCLEAR ACTIVATION DETERMINATION OF HEAVY METALS IN GREAT LAKES SEDIMENTS, SOILS, AND VEGETATION. Jervis, R. E. (Toronto Univ., Ontario (Canada). Dept. of Chemical Engineering and Applied Chemistry). 1973. 26p. (CONF-731173-2). INIS.

From symposium on water quality parameters-selection, measurement and monitoring; Burlington, Ontario, Canada (19 Nov 1973).

A combination of neutron and photonuclear activation techniques has been developed and applied for detecting traces of heavy metals from water pollution sources. Air-drive portions of sediments from several regions of the lower Great Lakes, organic cultivated soils and, selected edible vegetation from a heavily-irrigated marsh crop-growing area were subjected either to neutron irradiation for 25 to 50 h or to 15 to 40 MeV bremsstrahlung from the University of Toronto electron linear accelerator for 1 to 4 h. Many of the neutron activation determinations at low concentrations required post-activation chemical separations whereas an advantage of the photonuclear technique for use with such environmental samples was that multielement determinations could be done completely by an instrumental method. Elements of environmental interest determined in the activated samples included: As, Sb, Cd, Cr, Pb, Hg, Mo, Se, Tl, Zn and several others. The concentration ranges involved were from 0.1 to 500 parts per million and the typical analytical accuracy achieved varied from 5 to 15% as verified by comparison with other techniques and with standard reference materials. These studies have helped to identify some heavy metal water pollution sources and to elucidate the fate of such metals in sediment, soil-water-vegetation ecosystems. (auth)

672 (DP-1374) SAVANNAH RIVER LABORATORY ENVIRONMENTAL TRANSPORT AND EFFECTS RESEARCH. Annual report, 1974. Crawford, T. V. (comp.). (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Jun 1975. Contract AT(07-2)-1. vp. Dep. NTIS $7.60.

The principal objective of environmental transport research at the Savannah River Laboratory (SRL) is to develop, apply, adapt, use, test, and verify models that predict the directions and magnitude of ecosystem processes. Since an ecosystem is understood to be a complex ecological unit composed of physical, chemical, and biotic components interacting in the cycling and transport of matter and the flow of energy, the understanding of ecosystem processes demands integrated study by scientists of differing disciplines. Data are included from studies on factors that affect the atmospheric transport and dispersion of radionuclides and chemical effluents; surface and groundwater transport of various pollutants following release to the soil surface or a flowing stream; the uptake and retention of tritium oxide by pine trees; calculations of the radiation dose commitment for human populations from ^{14}C released by the nuclear industry; the effects of thermal effluents on aquatic organisms, including plankton productivity, the population dynamics of freshwater snails, and the growth and respiration rates of the sand-burrowing mayfly (Dolania americana). Data are included from a survey of seismic activity in South Carolina. (CH)

673 (DP-MS-75-72) MODEL FOR ESTIMATING AIR POLLUTANT UPTAKE BY FORESTS: CALCULATION OF FOREST ABSORPTION OF SULFUR DIOXIDE FROM DISPERSED SOURCES. Murphy, C. E. Jr.; Sinclair, T. R.; Knoerr, K. R. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Cornell Univ., Ithaca, N. Y. (USA); Duke Univ., Durham, N. C. (USA). School of Forestry). 1975. Contract AT(07-2)-1. 30p. (CONF-750854-2). Dep. NTIS $4.50.

From conference on the urban physical environment; Syracuse, New York, USA (25 Aug 1975).

The computer model presented in this paper is designed to estimate the uptake of air pollutants by forests. The model utilizes submodels to describe atmospheric diffusion immediately above and within the canopy, and into the sink areas within or

on the trees. The program implementing the model is general and can be used with only minor changes for any gaseous pollutant. To illustrate the utility of the model, estimates are made of the sink strength of forests for sulfur dioxide. The results agree with experimentally derived estimates of sulfur dioxide uptake in crops and forest trees. (auth)

674 (DP-MS-75-84) ENVIRONMENTAL CONTROL PROCEDURES AT THE SAVANNAH RIVER PLANT. Sheldon, E. B. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 26p. (CONF-750967-1). Dep. NTIS $4.50.

From 3rd ERDA environmental protection conference; Chicago, Illinois, USA (23 Sep 1975).

New environmental control activities in the past year at SRP have included improved control and reporting procedures for chemical spills, reclamation of high-value scrap from wastes, new disposal methods for solid wastes not suitable for the sanitary landfill, improved oil containment, and reduction of sediment discharges to on-plant streams. Interdepartmental committees provide the primary routes for planning and coordinating environmental protection throughout SRP. An improved site-use coordination procedure, developed and implemented by ERDA-SR, has provided more effective control and communication pertaining to activities of the several organizations actively using the 300-square-mile SRP site. (auth)

675 CONCENTRATION OF PARTICULATE TRACE METALS AND PARTICULATE ORGANIC CARBON IN MARINE SURFACE WATERS BY A BUBBLE FLOTATION MECHANISM. Wallace, G. T. Jr.; Duce, R. A. (Univ. of Rhode Island, Kingston). Mar. Chem.; 3: No. 2, 157-181(Jun 1975).

The transport of particulate organic carbon (POC) and particulate trace metals (PTM) to the sea surface by rising bubbles in samples of surface water collected in Narragansett Bay was examined using an adsorptive bubble separation technique. Recoveries of POC ranged from 30 to 59% while those of the particulate form of the trace metals, Al, Mn, Fe, V, Cu, Zn, Ni, Pb, Cr, and Cd were generally greater than 50%. The recovery data were used to arrive at a rough order of magnitude estimate of the bubble transport of POC and PTM under open-ocean conditions. While transport rates of the trace metals to the sea surface by both bubble transport and atmospheric deposition varied over approximately 3 orders of magnitude, the ratio of bubble transport to atmospheric deposition for most metals varied over approximately one order of magnitude, perhaps suggesting some degree of coupling between atmospheric PTM and bubble-transported PTM. (NL)

676 ACCUMULATION OF RARE EARTHS AND CIRCULATION OF CERIUM BY MOCKERNUT HICKORY TREES. Thomas, W. A. (Oak Ridge National Lab., TN). Can. J. Bot.; 53: No. 12, 1159-1165(15 Jun 1975).

Mockernut hickory (Carya tomentosa) trees accumulate the rare-earth elements in foliage in far greater concentrations than do other species on the same site (1350 ppm in ash, compared with less than 60 ppm by red maple, tulip tree, white oak, and black gum). Inoculation of hickory trees with ^{144}Ce showed that this typical rare-earth element moves slowly through woody tissues, with only a small percentage of total-tree cerium lost annually by leaf abscission. Slow decomposition of hickory litter further limits losses of rare earths from the tree-soil system. These processes create centers of rare-earth concentration that perpetuate themselves, exemplifying the role of accumulator species in determining the distribution of elements within ecosystems. (auth)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstract 2060.

General Detectors and Monitors

Refer also to abstracts 802, 992, 1397, 1810, 2067, 2321, 2325, and 2342.

677 (AED-CONF-75-141-004) RECONSTRUCTION OF A WHOLE-BODY COUNTER INTO A PROCESS COMPUTER-CONTROLLED LOW-LEVEL WHOLE-BODY SCANNER. Basic Knowledge and Preparatory Work for Electromechanics, Electronics, Interface Technique. Hamann, C. (Freie Univ. Berlin (F. R. Germany). Klinikum Steglitz). 1975. 18p. (In German). INIS.

From 6th scientific symposium of the German Society for Medical Physics; Berlin, F. R. Germany (28 Apr 1975).

A report is given on the state of the research project to reconstruct our whole-body counter with solid geometries into a scanning type. The object is to develop a process computer controlled "adaptive system." The self-built scan mechanics are explained and the advantages and problems of applying stepping motors are described. A stepping motor coordinates control is presented. As the planned scanner and the process computer form a digital control system, all theoretical and actual values as well as the control orders from the process computer must be directly controllable. A CAMAC system was not used for economical resons, the process periphery was made controllable by self-building of interfaces to and from the computer. For example, the available multi-channel analyzers were converted to external controlling. The price-moderate and relatively simple self-built set-up are outlined and an example is given of how a TELETYPE version is reconstructed into a fast electronic interface. A BUS-MULTIPLEX system was developed which generates all necessary DI/DO interfaces out of one DI and DO address of the process computer only. The essential part of this system is given. (auth)

678 AED-CONF-75-141-012) BODY COUNTER. A Survey of its Medical Applications. Koeppe, P. (Freie Univ. Berlin (F. R. Germany). Klinikum Steglitz). 1975. 25p. (In German). INIS.

From 6th scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik; Berlin, F. R. Germany (28 Apr 1975).

164 refs. with abstract.

The paper gives a survey on some applications of the whole body counter in clinical practice and a critical study of its application as a routine testing method. Remarks on the necessary precautions are followed by a more detailed discussion of the determination of the natural potassium content, the iron metabolism, the vitamin B12 test, investigations of the metabolism of the bone using ^{47}Ca and ^{85}Sr, investigations with iodine and iodine-labelled substances, clearance investigations (in particular the ^{51}Cr EDTA clearance test), as well as the possibilities of neutron activation in vivo. (GE)

679 (AED-CONF-75-141-013) PROCESSING OF SCINTIGRAMS BY LASER BEAMS. Bofilias, I. (Technische Univ. Muenchen (F. R. Germany). Nuklearmedizinische Klinik und Poliklinik). 1975. 5p. (In German). INIS.

From 6th scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Berlin, F. R. Germany (28 Apr 1975).

In order to improve the clinical information content of scintigrams, the coherent image produced by means of laser light and the filtering out of certain space frequencies through holographic filters are used. By integral transformations, disturbances such as camera aberration, kinetic unsharpness, 3-dimensional expansion of the organs as well as higher statistics with low impulse number may be suppressed. Particularly with fast changing processes, e.g. in the fast phases of the cerebral and cardial sequence scintiscanning and with perfusion-ventilation studies with xenon 133, image processing is important as is shown by a few examples. Finally, an electronic image processing method under development is referred to in which image scanning takes place by means of a sharp bundled laser beam. (GE)

680 . (GSF-S-298) MEASUREMENTS CONCERNING IONIZING RADIATIONS. Wachsmann, F.; Drexler, G. (Gesellschaft fuer Strahlen-und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). [nd]. 16p. (In German). INIS.

Having defined the term "ionizing radiation," the author deals with the measured quantities and units which are required for the description of the radiation field and the dosimetric quantities. After that, the measuring effects, methods and equipment used in radiation measuring technique, e.g. ionization chambers, proportional counters, Geiger–Mueller counters, solid detectors (semiconductors, scintillation counters, thermoluminescence and radiophotoluminescence dosemeters) are described as well as the mode of operation, measuring characteristics and major fields of application of film and chemical dosimetry. The tracer technique and the activation analysis are treated in more detail. A separate paragraph deals with radiation protection measurement and discusses the techniques used in measuring local and personnel doses as well as activities and contaminations (ionization method, film and solid dosimetry). (auth)

681 (INIS-mf–1408) SINGLE STAGE CENTRIPETER FOR RAPID DETECTION OF LONG LIVED ALPHA EMITTERS. Kotrappa, P.; Bhanti, D. P.; Dua, S. K.; Joshi, P. P (Bhabha Atomic Research Centre, Bombay (India)). 21p. (CONF-730495–3). INIS.

From 1st annual conference of Indian Association for radiation protection; Bombay, India (12 Apr 1973).

Rapid detection of long-lived alpha emitters such as, Pu, U, Th in air is rendered difficult because of the interference of radon and thoron daughter products always present in air. It is known that radon and thoron daughter products are usually associated with the aerosols of particle size less than 0.1 μm, whereas the man-made aerosols are usually larger than 1 μm. This property is made use of in a specially designed single stage centripeter operated at 1000 lit/min. This is found to have collection efficiency for long-lived isotopes around 65% and for short-lived isotopes around 3.0%. Comparison is made between the present instrument and an annular impactor, an instrument also based on the principle of size separation. It is concluded that this instrument has several desirable features compared to an annular impactor and is better suited for field use. (auth)

682 (INIS-mf-1698, pp 319-332) FISSION IONIZATION MULTILAYER CHAMBER WITH COOLING FISSILE TARGETS TILL 77° K. Aidemirski, P.; Bakalov, R.; Dermendzhiev, E.; Ilchev, G.; Konstantinov, K.; Chikov, N. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A description is given of a multilayered, ionization fission chamber with cooling of the fission targets and operating gas to a temperature of T ~ 77°K. Results are presented for a fission chamber having a working gas consisting of a mixture of Ne (70%), He (23%) and N (7%). It is shown that cooling of the gas and target to the temperature of liquid nitrogen does not change the operating characteristics of the ionization, fission chamber. (tr-SJR).

683 (INIS-mf-1698, pp 333-338) LOW-BACKGROUND TELESCOPE OF ALPHA PARTICLE·COUNTERS IN THE (n,α) REACTIONS. Dolya, G. P.; Bozhko, V. P.; Tutubalin, A. I. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A telescope of 4 proportional and one scintillation counter is described for counting alpha particles from (n,α) reactions during measurements of differential cross-sections. From the construction and method of turning on the counters it is possible to decrease noticeably the background level. Amplitude spectra are presented on counting alpha particles from the Cr-50 (n,α) Ti-47 reaction at angles of 0°, 90° and 150°. (tr-SJR)

684 (JINR–P13-8941) CHARACTERISTICS OF SMALL SECTIONAL ONE-COORDINATE PROPORTIONAL CHAMBERS. Zarubin, A. V.; Kiryushin, Yu.T.; Mikirtychyants, S. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The results of the investigations of sectional one-coordinate proportional chambers of 160 × 160 mm^2 on the β-source are presented. (auth)

685 (LBL-2887) RADIOGRAPHY WITH HEAVY PARTICLES. Benton, E. V.; Henke, R. P.; Tobias, C. A.; Cruty, M. R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1975. Contract W-7405-ENG-48. 68p. Dep. NTIS $5.45.

The failure of x-ray diagnostic techniques to accurately detect tumors and other regions of abnormal density in soft tissue has been, for many years, a significant shortcoming of this important technique in medicine. Accelerated heavy particles with plastics for track detection can be used to record small differences in density in soft tissues which may correspond to biological structures and abnormalities. In heavy-particle radiography (HPR), plastic detectors are well suited for recording images since their threshold nature makes them insensitive to spurious low-LET radiations and light secondaries. Sources of error which limit the resolution of HPR are inversely dependent on the atomic mass number (A) of the incident particle. Range straggling, responsible for loss of depth resolution, is proportional to $A^{-0.5}$ while multiple scattering which degrades lateral resolution is approximately proportional to $A^{-0.395}$. Recent experiments showing calcification in human blood vessels and soft tissue features in rats underline the potential of HPR as a diagnostic tool. High-resolution, three-dimensional reconstructions are possible using multiple layer plastic detectors and the short exposure time produces blur-free radiographs of specimens whose internal structure may be in motion. (auth)

686 (LBL-3851) PROPORTIONAL AND DRIFT CHAMBERS IN APPLIED INVESTIGATIONS. Perez-Mendez, V. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1975. Contract W-7405-ENG-48. 29p. (CONF-750684-1). Dep. NTIS $4.50.

From international meeting on proportional and drift chambers; Dubna, USSR (20 Jun 1975).

Various applications of Multiwire Proportional Chambers (MWPC) to problems in medical imaging of x-rays and gamma-rays, technical neutron radiography, x-ray crystallography and x-ray astronomy are reviewed. Various types of drift spaces, gas fillings and solid (boron, plastic, lead) converters for enhancing the detection efficiency of the MWPC to gamma and neutron radiations are discussed. (auth)

687 DIGITAL DATA PROCESSING OF IMAGES. Loetter, M. G.; Minnaar, P. C.; Verster, F.; Kleynhans, P. H. T.; Van Aswegen, A. (National Hospital, Bloemfontein (South Africa)); Van Heerden, P. D. R. (Karl Bremer Hospital, Bellville (South Africa)); Le Roux, P. L. M. (Groote Schuur Hospital, Cape Town (South Africa)). S. Afr. Med. J.; 48: 986-991(15 May 1974).

Digital data processing was investigated to perform image processing. Image smoothing and restoration were explored and promising results obtained. The use of the computer, not only as a data management device, but as an important tool to render quantitative information, was illustrated by lung function determination. The availability of on-line computers for image processing represents a major advance in the radiological investigation of organ function. (INIS)

688 NEUTRON DETECTOR. O'Boyle, M. J.; Nodvik, R. J. (to Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Swiss Patent Document 533840/D/. 30 Mar 1973. 4p. (In German).

A neutron flux detector is described which consists of a sealed enclosure containing at least two electrodes separated from each other and an ionizable gas in the space between the electrodes. A part of at least one of the electrodes is coated by a breeding material containing a certain proportion of ^{238}Pu. (tr-INIS)

689 PULSE-HEIGHT RESPONSE OF SILICON SURFACE-BARRIER DETECTORS TO HIGH-ENERGY HEAVY IONS. Smith, G. D. Rolla, MO; Univ. of Missouri (1973). 138p. University Microfilms Order No. 75-15,855.

Thesis (Ph. D.).

The pulse-height defect (PHD) of high-energy heavy ions in silicon surface-barrier detectors can be divided into three components: (1) energy loss in the gold-surface layer, (2) a nuclear-stopping defect, and (3) a defect due to recombination of electron-hole pairs in the plasma created by the heavy ion. The plasma recombination portion of the PHD was the subject of this study using the variation of the PHD with (1) the angle of incidence of incoming heavy ions, and (2) changes in the detector bias. The Tandem Van de Graaff accelerator at Argonne National Laboratory was used to produce scattered beam ions (^{32}S, ^{35}Cl) and heavy target recoils (Ni, Cu, ^{98}Mo, Ag, Au) at sufficient energies to produce a significant recombination defect. The results confirm the existence of a recombination zone at the front surface of these detectors and the significance of plasma recombination as a portion of the pulse-height defect. (Diss. Abstr. Int., B)

690 RECONSTRUCTION OF THE RADIONUCLIDE DISTRIBUTION IN A SCATTERING MEDIUM FROM A SCINTILLATION CAMERA IMAGE. Garcia, E. V. Miami, FL; Univ. of Miami (1974). 126p. University Microfilms Order No. 75-12,853.

Thesis (Ph. D.).

A computer oriented method has been developed which yields locations, shapes, volumes and activities of unknown radionuclide distributions in a scattering medium from a single view Anger-camera digital image. This method uses the predetermined values of the cube spread function calculated at various depths from the line spread functions measured in a scattering medium for a given isotope and collimator. A computer program adds digitally the response of sets of unit cubes of activity until a set is found whose two dimensional simulated image is fitted, by means of a chi-square fitting, to the original digital image. The mathematical theory which verifies this method of reconstruction is also developed. Using computer simulated distributions, actual phantoms, and actual clinical scans, the program was tested for its reliability of reconstruction as a function of various parameters such as the volume and activity of the radioactive distribution. The results obtained indicate that the accuracy of the reconstruction depends on the Poisson noise level of the image. (Diss. Abstr. Int., B)

691 MULTI-SENSOR RADIATION DETECTOR SYSTEM. Foster, R. G.; Cyboron, R. D. (to Combustion Engineering, Inc.). US Patent 3,879,612. 22 Apr 1975. Filed date 24 Aug 1973. 8p.

The invention is a multi-sensor radiation detection system including a self-powered detector and an ion or fission chamber, preferably joined as a unitary structure, for removable insertion into a nuclear reactor. The detector and chamber are connected electrically in parallel, requiring but two conductors extending out of the reactor to external electrical circuitry which includes a load impedance, a voltage source, and switch means. The switch means are employed to alternately connect the detector and chamber either with the load impedance or with the load impedance and the voltage source. In the former orientation, current through the load impedance indicates flux intensity at the self-powered detector and in the latter orientation, the current indicates flux intensity at the detector and fission chamber, though almost all of the current is contributed by the fission chamber. (auth)

692 GAMMA COMPENSATED PULSED IONIZATION CHAMBER WIDE RANGE NEUTRON/REACTOR POWER MEASUREMENT SYSTEM. Ellis, W. H. (to Secretary of the Navy). US Patent 3,873, 840. 25 Mar 1975. Filed Date 9 Nov 1973. 32p.

An improved method and system of pulsed mode operation of ionization chambers is described in which a single sensor system with gamma compensation is provided by sampling, squaring, automatic gate selector, and differential amplifier circuit means, employed in relation to chambers sensitized to neutron plus gamma and gamma only to subtract out the gamma component, wherein squaring functions circuits, a supplemental high performance pulse rate system, and operational and display mode selection and sampling gate circuits are utilized to provide automatic wide range linear measurement capability for neutron flux and reactor power. Neon is employed as an additive in the ionization chambers to provide independence of ionized gas kinetics temperature effects, and the pulsed mode of operation provide independence of high temperature insulator leakage effects. (auth)

693 ACCURATE CALIBRATION OF EFFICIENCIES OF X—RAY DETECTORS: FLOW-PROPORTIONAL AND SCINTILLATION COUNTERS. Loomis, T.C.; Keith, H.D. (Bell Laboratories, Murray Hill, New Jersey 07974). Appl. Spectrosc. 29: No. 4, 316-322 (July 1975).

Direct methods have been devised for calibrating the quantum efficiencies of two x-ray detectors: a Siemens flow-proportional counter in the energy range 2.6 to 11.2 keV, and a General Electric SPG 5 scintillation counter in the range 5.9 to 50.4 keV. Literature values for x-ray attenuation coefficients of detector components are used only to estimate small corrections for x-ray scattering. The largest known errors in the measurements are statistical errors in photon counting and range from 0.03 to 0.23%. In the energy range 5.9 to 11.2 keV, efficiencies of a lithium-drifted silicon detector measured by comparison with the two calibrated detectors as references agree satisfactorily. Linear attenuation coefficients have been measured for argon, methane and P—10 gas (90% Ar; 10% CH_4) in the energy range 2 to 12 keV; these can be used to calculate the efficiency of any flow-proportional counter of known geometry when used with counter gas consisting of a known mixture of argon and methane. (auth)

694 PROCESS AND APPARATUS FOR CONVERTING LIQUID BETA RADIATION SCINTILLATION COUNTER TO GAMMA RADIATION COUNTER. Noakes, J. E.; Menefee, J. M. (to Bioron Corp.). US Patent 3,898,460. 5 Aug 1975. Filed Date 1 Feb 1974. 14p.

A process and apparatus are disclosed for converting a conventional beta radiation liquid scintillation counter to detect gamma

radiation. Special mini-size counting vials are employed of the same size as those used in the detection of beta radiation but such vials detect gamma radiation, which is measured by the beta radiation liquid scintillation counter. These mini-size counting vials have relatively thin walls formed from scintillation crystal chips of an alkali metal halide and are preferably covered by and embedded in a polynuclear aromatic compound. (auth)

695 DEVICE FOR MEASURING NEUTRON FLUX. Kawashima, K. (to Mitsubishi Denki Kabushiki Kaisha). US Patent 3,898,466. 5 Aug 1975. Priority Date 9 Aug 1972, Japan. 10p.

The disclosed device comprises a gamma ray-compensated ionization chamber for producing a first output current caused from the irradiation with a neutron flux and gamma rays and a second output current substantially caused from the gamma rays alone. The second output current is amplified by an adjustable gain current amplifier having a wide dynamic range and then the second output current amplified is substracted from the first output current. The difference current provides a measure of the neutron flux. The amplifier has its amplification factor adjusted so as to increase the gamma compensation effect. (auth)

696 METHODS AND APPARATUS FOR HANDLING FLEXIBLE LIQUID SAMPLE CONTAINERS FOR SCINTILLATION SPECTROMETRY. Packard, L. E.; Schrodt, A. G. (to Packard Instrument Co., Inc.). US Patent 3,898,457. 5 Aug 1975. Filed Date 1 Nov 1973. 8p.

Methods and apparatus for handling flexible sample containers used for liquid scintillation spectrometry analysis where detector photomultiplier tubes are moved axially together "squeezing" the flexible container therebetween in the counting station to achieve close optical coupling are described. The sample containers may be made up of layered, flexible, light-transmissive, polyester film wherein the sample container portion is defined by joining the film layers. The flexible container may be individual units or a continuous strip and may include provision for identification data or records by way of a magnetic strip or punch character designation. Optimum counting efficiency is achieved with round flask-like configurations where the flexible container conforms to the shape of the photomultiplier tubes used therewith. (auth)

697 SCINTILLATION COUNTING APPARATUS. Noakes, J. E. (to Task, Inc.). US Patent 3,898,463. 5 Aug 1975. Filed Date 13 Aug 1973. 12p.

In the measurement of radiation by means of scintillation counters one drawback has been the scarcity of radiation counters which efficiently measure both gamma and beta radiation. There has also been the problem of scintillation counting in the face of external or background radiation. A scintillation counting apparatus is provided herein which measures scintillations arising from both beta and gamma radiation. The apparatus also effects a better separation of sample radiation from background radiation. The apparatus can also be used solely as a gamma detecting instrument. In such apparatus a radioactive sample is placed in a housing coupled to a photomultiplier. In this apparatus the housing itself is an inorganic phosphor. (auth)

698 ION CHAMBER INSTRUMENT. Stephan, D. H. (to VLN Corp.). US Patent 3,898,464. 5 Aug 1975. Filed Date 25 Mar 1974. 6p.

An electrical ionization chamber is described having a self-supporting wall of cellular material which is of uniform areal density and formed of material, such as foamed polystyrene, having an average effective atomic number between about 4 and about 9, and easily replaceable when on the instrument. (auth)

699 EFFECTS OF PERMEABILITY OF POLYETHYLENE VIALS IN LIQUID SCINTILLATION COUNTING. Neame, K. D. (Liverpool Univ.). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 393-397(Jan 1975).

The effects of the permeability of polyethylene counting vials on the liquid scintillation counting of radioactive materials and channels ratios have been examined. The count rate of toluene-soluble and water-soluble radioactive material dissolved in a suitable scintillation mixture altered by not more than 5% in 4 days. The sample channels ratio altered only slightly or not at all. Changes in external standard channels ratio varied between 3 and 25% in that time, depending on scintillation mixture and temperature of storage. Changes were in all cases greater if vials containing prepared samples were kept at 20°C than if they were kept at 5°C. If n-hexadecane radioactive standard was dispenced into empty polyethylene vials there was a reduction in counting efficiency related to the delay before adding the scintillation mixture; the efficiency fell 5% within 2 hr. (auth)

700 EFFECT OF THE CONNECTING CIRCUIT ON CERTAIN PARAMETERS OF AN X-RAY PROPORTIONAL COUNTER. Klyukvina, E. F. Instrum. Exp. Tech.; 18: No. 1, 55-56(1975)

Translated from Prib. Tekh. Eksp.; 18: No. 1, 55-56(1975).

The rise time and the pulse height of an x-ray proportional counter are calculated in relation to the form of the connecting circuit. The effect of an RC circuit on the time characteristics of such a counter is considered. (auth)

701 MINIATURE SPHEROCYLINDRICAL GOLD: SILICON DETECTOR FOR NUCLEAR RADIATIONS. Petushkov, A. A.; Manchuk, V. A.; Pryakhin, Yu. F. (Inst. of Labor Hygiene and the Prevention of Illness, Moscow). Instrum. Exp. Tech.; 18: No. 1, 51-54(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 51-54(1975).

A technology for making miniature spherocylindrical silicon detectors of the surface-barrier type is described. The detector has a highly isotropic character and may be employed for recording α, β, x, and γ radiations. The spectrometric properties of the detector are adequate for many problems of applied nuclear physics. The width of the peak arising from the conversion electrons of a ^{137}Cs source (measured at half its height) is ~30 keV when the axis of the detector is oriented along the direction of propagation of the particles. When using the detector as an immersible sensor it has a sensitivity (with respect to α activity) of ~10 pulses·ml/sec·μ Ci. (auth)

702 AMPLITUDE–TIME ANALYZER FOR USE IN SEEKING NEW HEAVY PARTICLES AND ANTINUCLEI. Baldin, B. Yu.; Krumshtein, Z. V.; Khemnits, G.; Khovanskii, N. N.; Shavlovski, M. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech.; 18: No. 1, 71-74(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 69-72(1975).

A simple and reliable system of amplitude–time analysis providing for the simultaneous recording of up to 56 parameters is developed. The integrated nonlinearity arising from the inputs of the amplitude–time converter is no worse than 0.3%, the differential nonlinearity no worse than 2 to 3%. The drift of the measuring tracts may be eliminated by means of computer-calculated corrections. (auth)

703 INVESTIGATION OF THE PERSISTENT COMPONENTS OF LUMINESCENCE OF NaI(Tl) AND CsI(Tl) SCINTILLATORS BY THE ONE-ELECTRON METHOD. Mandzhukov, I.; Kolev, D.; Mandzhukova, B.; Bonchev, Ts. (Univ., Sofia). Instrum. Exp. Tech.; 18: No. 1, 66-70(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 64-68(1975).

An installation is described for the investigation of the persistent luminescence components of NaI(Tl) and CsI(Tl) scintillators by the one-electron method. Results are presented of measurements at crystal temperatures of 0 and 26°C; a strong dependence of the intensity of the persistent components on temperature is revealed. The possibilities of using the described procedure for studying traps in crystals and monitoring crystal quality, in batching, spectroscopy, etc., are discussed. (auth)

704 SCINTILLATION PULSE RISE TIME IN CsI AS A FUNCTION OF ACTIVATOR CONCENTRATION AND TEMPERATURE. Abduvaliev, A. S.; Volkov, N. G.; Lyapidevskii, V. K.; Prorvich, V. A.; Shamovskii, L. M. (Moscow Engineering Physics Inst.). Instrum. Exp. Tech.; 18: No. 1, 63-65(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 61-63(1975).

The dependence of scintillation pulse rise time in CsI crystals on Tl and Na activator concentration and temperature was studied by the one photon method. The rise time of the radiation is determined by the diffusion of holes from the place of formation to radiation activator centers. It is shown that the diffusion time is determined by the number of intermediate autolocalization centers with formation of V_k centers. The activation energy of autolocalized holes is determined. (auth)

705 MULTIDETECTOR ATTACHMENT TO A PULSE TIME-DISTRIBUTION ANALYZER. Volkov, S. P.; Shishin, B. P. Instrum. Exp. Tech.; 18: No. 1, 103-104(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 95-96(1975).

The operating principle and construction of an attachment to a pulse time-distribution analyzer is described by means of which the pulses from a large number of detectors can be analyzed almost simultaneously. The attachment together with an analyzer can be used to study the space–time fields of neutrons in a nuclear reactor. (auth)

706 CHOICE OF THE OPTIMAL DIMENSIONS OF PLASTIC SCINTILLATORS SHAPED IN THE FORM OF FILAMENTS, CAPILLARIES, AND HOLLOW CYLINDERS. Achkasov, S. K.; Il'ichev, O. V.; Kolobashkin, V. M.; Nesterov, V. M.; Novichkov, V. P.; Gudkov, A. N.; Nekrasov, V. I.; Serbulov, Yu. A. (Moscow Engi-

neering-Physics Inst.). Instrum. Exp. Tech.; 18: No. 1, 60-62 (1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 59-61(1975).

The passage of light through filaments, capillaries, and plates made of scintillating plastic (polystyrene + 2% paraterphenyl + 0.2% POPOP) was investigated. It was found that the ratio between the height and radius for hollow cylindrical scintillators filled with nonabsorptive β-active gas must be equal to 1.5 to 2.5, while an increase in the length of the filament (1.2 and 1.5 mm in diameter) and the capillaries (2 mm in diameter) exceeding 5.8 and 10 cm, respectively, is inexpedient. (auth)

707 ELIMINATION OF LOSSES DURING SHAPING OF PULSES THAT ARE STATISTICALLY DISTRIBUTED IN TIME. Abduragimov, F. A.; Garibov, M. A.; Guseinov, N. L.; Dzhafarov, A. G. Instrum. Exp. Tech.; 18: No. 1, 136-138(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 122-124(1975).

A method is described for the elimination of losses during the shaping of pulses that are statistically distributed in time; this is done by separating the pulses occurring during the dead time of a shaper of nonprolonging type. The separated pulses are recorded in a shift register and used only in the absence of input pulses and after the previous pulse has been shaped; thus it is possible to smooth the statistically distributed pulses. (auth)

708 BROMINE-QUENCHED HIGH TEMPERATURE G-M TUBE WITH PASSIVATED CATHODE. Mitrofanov, N. (to Kewanee Oil Co.). US Patent 3,892,990. 1 Jul 1975. Filed date 31 Jul 1972. 8p.

A bromine doped self-quenching Geiger-Mueller tube having an operational life expectancy in excess of 1,200 hours at a temperature of 315^{0}C is described. The tube comprises a passivated metal coated cathode which is conditioned or aged for operation at room temperature, thus obviating the necessity of thermally cycling the tube at progressively elevated temperatures. Useful metal coatings for the cathode include chromium, platinum, and nickel-copper alloys deposited in a layer less than about 1 mil thick. A method for passivating the metal coated cathode and subsequently conditioning the tube and its contents is disclosed. (auth)

709 RADIATION DETECTOR SYSTEM USING AN INORGANIC SCINTILLATOR CRYSTAL DETECTOR WITH AN OPTICAL FILTER FOR AERIAL DOSIMETRY. Arthur, W. E.; Carrell, T.; Crego, W. (to Secretary of the Army). US Patent 3,892,971. 1 Jul 1975. Filed date 22 Mar 1974. 4p.

A radiation detector system used in aerial dosimetry in which an inorganic scintillation crystal detector and spectral filter are coupled to a photomultiplier tube and the requisite electronic circuits is described. The crystal detector is pointed toward an area to be monitored for x-ray or gamma ray and the resulting optical radiation therefrom is applied to the photomultiplier tube for converting to an electrical output therefrom which is monitored to indicate the radiation dosage. (auth)

710 RADIATION SENSING DEVICE. Richey, J. B. (to Ohio Nuclear, Inc.). US Patent 3,908,128. 23 Sep 1975. Filed date 12 Sep 1973. 8p.

A radiation sensing device including a collimator, a disc-shaped scintillation crystal in close proximity thereto, photomultiplier tubes for viewing the scintillations and circuitry for locating the scintillation in the crystal is described. A diode or other nonlinear compensation means is biased by an A.C. and D.C. source and thereby corrects for distortion and non-uniformity of the field. (auth)

711 SCANNER FOR THE RECORDING OF RADIOACTIVITY DISTRIBUTION. Seebeck, U. (to U. S. Philips Corp.). US Patent 3,902,065. 26 Aug 1975. Priority date 23 Aug 1972, F. R. Germany. 4p.

In a scintiscanner comprising an upper measuring head and a lower measuring head and associated write heads, the activity distribution measured by the lower measuring head is recorded in the form of a mirror-image if the write heads in the two recording directions are moved in the same direction with respect to each other. However, if the write heads in the one recording direction are displaced opposite to each other, a correct recording is obtained, but it is then very difficult to compare the scintigrams recorded by the measuring heads. The invention describes a simple mechanical device by means of which the write heads can be moved in the same or in the opposite direction with respect to each other. (auth)

712 VIBRATION RESISTANT GEIGER-MUELLER TUBE. Clark, J. (to United States of America as represented by the Secretary of the Air Force). US Patent 3,902,092. 26 Aug 1975. Filed date 11 Apr 1974. 14p.

A halogen quenched, Geiger-Mueller tube having a stannic oxide coated tubular glass anode supported in delineated clearance-fit supports, with dynamic vibration absorbers, provides a multiple-supported, substantially resonate free, anode structure and an improved Geiger-Mueller tube that withstands extreme vibratory components. (auth)

713 IMAGING CHARACTERISTICS OF GAMMA-RAY COLLIMATORS. Ehrhardt, J. C.; Oberly, L. W.; Lensink, S. C. (Univ. of Iowa, Iowa City). Radiology; 117: No. 2, 433-439(Nov 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Imaging characteristics of 43 commercial gamma-ray collimators for rectilinear scanners were measured. The modulation transfer functions, plane sensitivity, full width at half maximum, depth-of-field, and focal length for each collimator are reported. The products of all five companies examined appear to represent the current state of the art. (auth)

714 METHOD FOR THE DETERMINATION OF Ge(Li) DETECTOR EFFICIENCIES FOR GAMMA RAYS. Alian, A.; Sanad, W.; Hassan, A. M. (Atomic Energy Establishment, Cairo). Radiochem. Radioanal. Lett.; 22: No. 6, 371-378(27 Sep 1975).

An approach is presented, in which detector efficiencies for γ-rays of different energies can be determined. The proposed method is based on the measurement of the γ-spectrum of an epicadmium irradiated mixture, containing known amounts of some elements giving rise to long-lived radioactive isotopes, not necessarily having more than one γ-line. A good agreement with the conventional determination of detector efficiencies was obtained. (auth)

715 SENSITIVITY OF OPEN GEIGER-MUELLER COUNTERS FOR IONS WITH ENERGIES FROM 0.3 keV TO 3 keV. Berresheim, K. Cologne; Cologne Univ. (1974). 89p. (In German). INIS.

Thesis.

The counting characteristics and the sensitivity of open Geiger-Mueller counters were investigated with the help of a device for the production of ions of known mass and energy. Oil and iodine vapours were used as counting gas. (GE)

716 PARTICLE IDENTIFICATION BY PROCESSING OF SIGNALS FROM MULTIPLE DETECTORS. Gatti, E.; Radeka, V.; Rosenblum, M. (Brookhaven National Lab., Upton, NY). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2014-2021(Oct 1975).

It is shown that for particle identification it is convenient to develop instrumentation based on coding the output of the detectors according to the ratio of probabilities that a particular signal is given by the two kinds of particles considered. Particular emphasis has been given to uncorrelated responses of each detector of a set, but the case of correlated responses leads to obvious extensions of the ideas presented. Transition radiation detectors are studied. (WHK)

717 PRINTED LOW VELOCITY DELAY LINES FOR CATHODE READOUT OF PROPORTIONAL CHAMBERS. Bosshard, R.; Chase, R. L.; Fischer, J.; Iwata, S.; Radeka, V. (Brookhaven National Lab., Upton, NY). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2053-2057(Oct 1975).

A new type of flat delay line was developed which has a low propagation velocity and very good delay to rise time ratio. It can be constructed by printed circuit techniques without crossovers. The magnetic loops of a shifted periodic structure yield high inductance per unit length. Geometric scaling factors are shown. This line, forming the cathode plane of a proportional chamber, allows simultaneously, a satisfactory induced signal and the read-out of the second coordinate by time delay without disturbing the electric field configuration around the anode. Optimization of position resolution vs. noise is discussed. Experimental results are shown. Other properties of such delay lines are discussed. (auth)

718 APPLICATION OF NUCLEAR INSTRUMENTATION TECHNIQUES TO X-RAY DIFFRACTION FROM MUSCLE. Faruqi, A. R. (MRC Laboratory of Molecular Biology, Cambridge, Eng.). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2066-2073(Oct 1975).

The applications of position sensitive counters and multichannel analyzers to X-ray diffraction data collection from live muscle undergoing contraction are described. Electronic data collection methods are described which enable time resolved studies of the X-ray patterns. It is expected that such information will lead to a clearer understanding of the structural changes, at a molecular level, taking place during muscular contraction. (auth)

719 TOWARDS PICOSECOND RESOLUTION. Contribution of Microchannel Electron Multipliers to Vacuum Tube Design. Pietri, G. (Laboratories d'Electronique et de Physique Appliquee,

Limeil, France). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2084-2092(Oct 1975).

The development and operation of a microchannel plate and its use in photoelectric transducers, photoelectric converters, and streak camera and wide band CRT for picoseconds time resolution are reviewed. The uses of microchannel photomultipliers in hodoscopes, Cherenkov detectors, and a new imaging detection system are discussed. (WHK)

720 SCINTILLATION COUNTER: PHOTOMULTIPLIER TUBE ALIGNMENT. Olson, R. E. (to Packard Instrument Co., Inc.). US Patent 3,890,505. 17 Jun 1975. Filed date 27 Jul 1973. 8p.

A scintillation counter, particularly for counting gamma ray photons, includes a massive lead radiation shield surrounding a sample-receiving zone. The shield is disassembleable into a plurality of segments to allow facile installation and removal of a photomultiplier tube assembly, the segments being so constructed as to prevent straight-line access of external radiation through the shield into the sample receiving zone. Provisions are made for accurately aligning the photomultiplier tube with respect to one or more sample-transmitting bores extending through the shield to the sample receiving zone. A sample elevator, used in transporting samples into the zone, is designed to provide a maximum gamma-receiving aspect to maximize the gamma detecting efficiency. (auth)

721 RADIATION DETECTOR USING A DIGITAL ELECTROMETER SCALER. Luger, P. P. (to Pioneer Educational Society). US Patent 3,875,410. 1 Apr 1975. Filed date 28 Apr 1970. 12p.

A digital system is described for automatically operating an electrometer. A binant electrometer is employed with a quartz fiber mounted at one end but free to vibrate at the other in an AC field. The fiber oscillates if a charge is placed upon it. An optical slit replaces the ordinary eyepiece reticule scale. With the quartz fiber adjusted so its image is in focus at the optical slit, photoelectric signals are obtained at null charge on the fiber. The quartz fiber is repeatedly charged and allowed to discharge by collecting ions from a source under measurement. Each photoelectric signal causes a digital time reading to be taken. The time readings are used to evaluate the current due to the collected charge. The photoelectric signals, by feedback, also operate the electrometer for continuous or intermittent-continuous operation. Basically the system is a current digitizer. Analog recording with this single slit real image system is also described. Application is explicitly made to reactor monitoring and control; other types of production control are indicated. The method is applied to the measurement of force in other types of fields. (auth)

722 PENETRATING RADIATION EXAMINING APPARATUS IN COMBINATION WITH BODY LOCATING STRUCTURE. Hounsfield, G. N.; Gibbons, D. J. (to EMI Ltd.). US Patent 3,881,110. 29 Apr 1975. Priority date 17 May 1972, United Kingdom of Great Britain and Northern Ireland. 8p.

Apparatus for investigating a part of a body intermediate the extremities thereof by means of X- or gamma-radiation is disclosed. The body part is surrounded by a liquid medium; the liquid medium being retained in an enclosure having a tubular inner wall formed of flexible material, and the body part is located within the inner wall. The liquid medium can be pressurized to cause the flexible inner wall to fit intimately the periphery of the body part. (auth)

723 METHODS AND APPARATUS FOR DETERMINING THE SPATIAL DISTRIBUTION OF A RADIOACTIVE MATERIAL. Todd, R. W. (to National Research Development Corp.). US Patent 3,876,882. 8 Apr 1975. Priority date 28 Mar 1972, United Kingdom of Great Britain and Northern Ireland. 12p.

The spatial distribution of a radioactive material is determined by locating the positions of and energy losses resulting from Compton interactions which occur in a detector as a result of gamma photons emitted by the radioactive material, which may, for example, have been administered to a patient for medical diagnostic investigation. (auth)

724 RADIATION DETECTION DEVICE AND A RADIATION DETECTION METHOD. Blum, A. US Patent 3,878,373. 15 Apr 1975. Filed date 30 Jun 1971. 8p.

A radiation detection device is described including at least one scintillator in the path of radiation emissions from a distributed radiation source; a plurality of photodetectors for viewing each scintillator; a signal processing means, a storage means, and a data processing means that are interconnected with one another and connected to said photodetectors; and display means connected to the data processing means to locate a plurality of radiation sources in said distributed radiation source and to provide an image of the distributed radiation sources. The storage means includes radiation emission response data and location data from a plurality of known locations for use by the data processing means to derive a more accurate image by comparison of radiation responses from known locations with radiation responses from unknown locations. (auth)

725 APPARATUS FOR SENSING RADIATION AND PROVIDING ELECTRICAL READ OUT. Michon, G. J.; Burke, H. K. (to General Electric Co.). US Patent 3,882,531. 6 May 1975. Filed date 29 May 1973. 12p.

In an array of radiation sensing devices each including a pair of closely coupled conductor-insulator-semiconductor cells on a common substrate, each of the devices is addressed in sequence for read out. Read out of a device is accomplished by reducing the amplitudes of the voltages on the cells of the device in sequence to inject charge stored in the cells into the substrate and by sensing such injected charge. The device is reset for the next cycle of operation by reestablishing voltages in sequence on the cells. Means are provided in the bulk of the substrate to collect injected charge to avoid recollection by the cells of the device of such charge which has not had sufficient time to recombine or diffuse in the substrate away from the vicinity of the cells. (auth)

726 APPARATUS FOR SENSING RADIATION AND PROVIDING ELECTRICAL READOUT. Eichelberger, C. W.; Engeler, W. E.; Tiemann, J. J. (to General Electric Co.). US Patent 3,890,500. 17 Jun 1975. Filed date 11 Feb 1974. 20p.

An array of radiation sensing devices each including a pair of closely coupled conductor- insulator-semiconductor cells, one a row line connected cell and the other a column line connected cell, is provided on a common semiconductor substrate connected to ground. Read out of a device is accomplished by reducing the voltage on the row line of the device to cause stored charge to flow to the column connected cell of the device and thereafter reducing the voltage on the column line of the device to inject the charge stored therein into the substrate. Circuit means is provided in series relationship with the addressed column line to integrate the current flow in the column line due to the injected charge. In another embodiment the column conductor lines are arranged in a plurality of consecutively numbered sets, each set including the same number of consecutively numbered column lines. A plurality of charge integrating means are provided each connected between a respective column line of a set and ground for simultaneous read out of charges through the column lines of a set. Switch means are provided for connecting each set of column lines in turn for read out. A plurality of video signals equal in number to the number of sets are obtained. The video signals may be multiplexed to obtain a composite video signal. (auth)

727 RADIATION DETECTING DEVICE. Halsor, J. L.; Dewit, P.; Irwin, E. L. (to Westinghouse Electric Corp.). US Patent 3,896,309. 22 Jul 1975. Filed date 21 May 1973. 6p.

A multiwavelength radiation detector having the ability to integrate received radiation is described. The detector comprises a modified MOS field effect transistor wherein the gate takes the form of a cantilevered member formed from two layers of material of differing coefficients of expansion, one above the other. The free end of the cantilevered member extends over the space between the source and drain regions of the field effect transistor. As radiation impinges upon the cantilevered member, it will bend, causing the distance between the gate and the underlying semiconductive substrate to vary. In this manner, and assuming a constant gate voltage, the surface conductivity of the substrate between the source and drain regions can be made to vary as function of the integrated value of rediation which has impinged on the cantilevered member over a selected time interval. Such detectors can be connected in arrays, such that a radiation pattern over an area can be determined. (auth)

728 GLASS ANODE GEIGER–MUELLER TUBE. Tessler, L. P. (to Secretary of the Air Force). US Patent 3,903,444. 2 Sep 1975. Filed date 11 Dec 1973. 4p.

A halogen quenched, Geiger-Mueller tube having a glass supported stannic oxide coated tubular glass anode centrally positioned in a cylindrical platinum iridium cathode is disclosed. (auth)

729 NEUTRON DETECTOR. Klar, E.; Haller, P.; Runge, E. G. (to Siemens Aktiengesellschaft). US Patent 3,904,881. 9 Sep 1975. Priority date 9 Aug 1972, F.R. Germany. 4p.

A self-powered neutron detector is described for use in the presence of gamma radiation and of the type including a collector, with electrical insulating material separating the collector from an emitter which is not only sensitive to neutron flux but also to gamma radiation so that the electrical output of the detector represents not only a value of the neutron flux as desired, but also of the gamma radiation. To reduce or eliminate this undesirable effect of the gamma radiation, the emitter is made to

include an added material having a gamma sensitivity differing from that of the first mentioned material to thereby provide a compensation reducing or eliminating the output of the detector due to the gamma radiation. (auth)

730 GAMMA CAMERA. Conrad, B.; Heinzelmann, K. G. (to Siemens Aktiengesellschaft). US Patent 3,906,234. 16 Sep 1975. Priority date 5 Oct 1972, F.R. Germany. 6p.

A gamma camera is described which obviates the distortion of locating signals generally caused by the varied light conductive capacities of the light conductors in that the flow of light through each light conductor may be varied by means of a shutter. A balancing of the flow of light through each of the individual light conductors, in effect, collective light conductors may be balanced on the basis of their light conductive capacities or properties, so as to preclude a distortion of the locating signals caused by the varied light conductive properties of the light conductors. Each light conductor has associated therewith two, relative to each other, independently adjustable shutters, of which one forms a closure member and the other an adjusting shutter. In this embodiment of the invention it is thus possible to block all of the light conductors leading to a photoelectric transducer, with the exception of those light conductors which are to be balanced. The balancing of the individual light conductors may then be obtained on the basis of the output signals of the photoelectric transducer. (auth)

731 CHARGED PARTICLE DETECTOR. Hagen, R. D. US Patent 3,906,230. 16 Sep 1975. Filed date 3 Apr 1974. 8p.

A device for detecting the emission of charged particles from a specimen is described. The specimen is placed within an accumulator means which statically accumulates any charged particles emitted from the specimen. The accumulator means is pivotally positioned between a first capacitor plate having a positive electrical charge and a second capacitor plate having a negative electrical charge. The accumulator means is attracted to one capacitor plate and repelled from the other capacitor plate by an amount proportional to the amount and intensity of charged particles emitted by the specimen. (auth)

Radiation Dosimeters

Refer also to abstracts 894 and 2207.

732 (AED-CONF-75-103-003) FAST ISODOSE SCANNER FOR RADIATION PROTECTION TESTS WITH LABORATORY MODELS OF MEDICAL X-RAY EQUIPMENT. Gehm, U.; Mueller, C. H. F. (Philips Forschungslaboratorium G.m.b.H., Hamburg (F. R. Germany)). 1975. 3p. (In German). INIS.

From symposium on practical experience with radiation control as specified in paragraph 4.1 of the X-Ray Ordinance; Braunschweig, F. R. Germany (15 Apr 1975).

The paper describes a system which allows fast and largely automatic plotting of the isodose curves of an X-ray diagnostic apparatus and has been designed for optimization of radiation protection in prototypes. While the detector is held at a fixed height, the isodose curves are measured in equidistant steps—which may be determined by the operator—and then plotted down by an X-Y writer. The detectors are chosen to meet the requirements made on them. (auth)

733 (AED-CONF-75-141-007) CALIBRATION OF IONIZATION CHAMBERS IN ENERGY DOSE UNITS. Pychlau, P. J. (Physikalisch-Technische Werkstaetten, Freiburg im Breisgau (F. R. Germany)). 1975. 5p. (In German). INIS.

From 6th scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik; Berlin, F. R. Germany (28 Apr 1975).

2 refs.

The construction of a probe ionization chamber is described which easily allows the measurement of depth dose distributions in energy dose in tissue-equivalent phantoms without considering the change of the HWD of the bremsstrahlung spectrum when penetrating into deeper phantom layers. (GE)

734 (EUR--5358e) RADIOLOGICAL PROTECTION-3. Technical Recommendations for the Use of Thermoluminescence for Dosimetry in Individual Monitoring for Photons and Electrons from External Sources. (Commission of the European Communities, Luxembourg). 1975. 52p. Dep. NTIS (US Sales Only) $5.75.

The advantages of thermoluminescence dosimetry for monitoring personnel are discussed. The properties of thermoluminescent detectors and sources of possible errors in thermoluminescent dosimetry are reviewed. (CH)

735 (GSF-BC-87) CORRELATION BETWEEN PARAMAGNETIC AND OPTICAL MEASUREMENTS ON SILVER-ACTIVATED PHOSPHATE GLASSES. Deffner, U.; Regulla, D. F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany)). 1974. 13p. (AED-CONF-74-429-002). INIS.

From 4th international conference on luminescence dosimetry; Krakow, Poland (27 Aug 1974).

By irradiation of silver-activated phosphate glasses there are different centers formed giving rise to optical absorption, ESR and fluorescence (RPL). On the latter phenomenon an established dosimetry technique is based. For its improvement, a better understanding of the physical fundamentals is of interest, particularly on the kind of the dosimetric relevant RPL centers. The center structure was studied by correlating the significant signals of the ESR, RPL and optical density spectra. The investigations mainly concerned the changes in the above spectroscopic signals due to isothermal and isochronic annealing. Varying parameters have been the silver concentration and the dose levels to which the glasses have been exposed. As a result, new data have been found on the RPL mechanism, partly in disagreement with the present state of knowledge. In general, silver turned out to be necessary for the generation of an RPL center, but not sufficient. It could be shown that not all radiation-induced silver centers contribute to luminescence. The ratio between the luminescent and non-luminescent centers related to silver depends on the magnitude of dose applied and on the silver concentration. The two emission bands present in a typical RPL spectrum could not be attributed to simple paramagnetic silver centers formed by irradiation. (auth)

736 (GSF-S-300) POSSIBILITIES AND PROBLEMS OF MODERN DOSIMETRY TECHNIQUES IN DENTISTRY. Regulla, D. F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). [nd]. 7p. INIS.

Basic requirement for an optimized application of radiation in dentistry is a qualified dosimetry. The paper introduces new dosimetry techniques based on solid state phenomena, such as luminescence and exoelectron emission, which, in the case of dentistry, appear superior to conventional methods such as film and ionization chamber dosimetry. Advantages of the TLD dosimeters, such as miniature detector volume, dynamic detection range, tissue equivalence etc., and their dosimetric possibilities are described together with hints on operational problems with respect to achieving high dosimetric measurement accuracy. (auth)

737 IONIZATION DOSEMETER. Cooper, P. N.; Tymons, B. J. (to Stephen (R. A.) and Co. Ltd., Mitcham (UK)). Swiss Patent Document 535959/D/. 30 May 1973. 4p. (In German).

A description is given of an ionization dosimeter with two ionization chambers having substantially different ratios between the response to neutrons and to γ rays. The corresponding electrodes of the two chambers are connected electrically with each other and the other two electrodes are coupled by a coupling capacity. The two chambers are combined by being charged electrically with opposed polarities in such a manner that the voltage appearing at the terminals of the coupling capacity is proportional to the difference between the response of the two chambers to the radiation received. There is an apparatus to indicate the amplitude of the variation of the voltage between the electrodes of the chamber having the largest ratio between the sensitivity to neutrons and to γ rays. (tr-INIS)

738 THERMOCURRENT DOSIMETRY WITH HIGH PURITY ALUMINUM OXIDE. Fullerton, G. D. Madison, WI; Univ. of Wisconsin (1974). 145p. University Microfilms Order No. 75-9971.

Thesis (Ph. D.).

The application of thermocurrent (TC) to ionizing radiation dosimetry was studied. It was shown that TC in alumina (Al_2-O_3) has properties that are suited to personnel dosimetry and environmental monitoring. TC dosimeters were made from thin disks of alumina. Aluminum electrodes were evaporated on each side: on one face a high voltage electrode and on the opposite face a measuring electrode encircled by a guard ring. Exposure to ionizing radiation resulted in stored electrons and holes in metastable trapping sites. The signal was read-out by heating the dosimeter with a voltage source and picoammeter connected in series between the opposite electrodes. The thermally remobilized charge caused a transient TC. The thermogram, TC versus time or temperature, is similar to a TL glow curve. Either the peak current or the integrated current is a measure of absorbed dose. Results are given and discussed. (WHK)

739 MAINTENANCE OF CONDENSER-ION CHAMBER CALIBRATION. Rozenfeld, M. (Department of Radiology, University of Chicago and The Franklin McLean Memorial Research Institute,* Chicago, Illinois 60637). Med. Phys. 2: No. 5, 274-277 (Sept 1975).

Readings made with condenser-ionization chamber systems are frequently suspect because significant changes in calibration can occur

without being evident in the normal use of the instruments. These changes can be traced to physical causes that alter the voltage sensitivity or electrical capacitance. Thus, measurement of these electrical parameters will indicate whether or not a change in calibration has occurred. Formulas are presented for calculating such changes and determining which parameter is responsible. Good agreement was obtained between the results of calculations with these formulas and the results of radiation measurements made with a Victoreen Condenser R-Meter after several components had been deliberately maladjusted. (auth)

740 FERROUS SULPHATE G-VALUE FOR CYCLOTRON PRODUCED NEUTRONS WITH A MEAN ENERGY OF 7.6 MeV. Greene, D. (Christie Hospital and Holt Radium Inst., Manchester, Eng.); Law, J.; Miles, J. C. H.; Parnell, C. J. Phys. Med. Biol.; 20: No. 4, 650-652(Jul 1975).

The G-value for the $FeSO_4$ dosemeter system has been measured for the fast neutron beam from the MRC cyclotron at the Hammersmith Hospital. This machine produces neutrons by accelerating deuterons to an energy of 16 MeV on to a beryllium target, giving a continuous spectrum of neutrons extending to a maximum energy of about 20 MeV and a mean energy of 7.6 MeV. The dosimetry was based on measurements of the total (neutron and gamma ray) dose made with a polythene-ethylene ionization chamber and a tissue-equivalent ionization chamber. The G-values were determined in terms of the total dose given to the specimens; the γ-ray component of the dose in the collimated beam was (5 ± 2)%. A check on the performance of the system as a whole was provided by irradiating a similar number of vessels with ^{60}Co irradiation to the same oxidation level as the cyclotron irradiations, and comparing the resultant dose estimates with ionization measurements made using a calibrated Farmer dosemeter. Comparison of the results obtained with ferrous sulphate solutions and irradiation vessels from both Manchester (G-value 9.74 ± 0.10, 17 irradiations) and Edinburgh (G-value 9.59 ± 0.07, 18 irradiations) using doses from 300 to 4000 rad of cyclotron neutrons, and with predicted $FeSO_4$ G-values for various high energy neutron beams (Lawson, R. C., and Porter, D., 1975, Phys. Med. Biol., 20, 420) demonstrated an agreement between experimental and theoretical G-values, for DT as well as cyclotron neutrons, which was within the rather large experimental and theoretical uncertainties. (UK)

741 AUTOMATIC X-RAY ISODOSE PLOTTER. Haskard, D. L. (Adelaide Univ.). Phys. Med. Biol.; 20: No. 4, 645-649 (Jul 1975).

One requirement for accurate radiotherapy with X-ray beams is a knowledge of the dose distribution in a tissue-equivalent medium such as a water phantom. The usual information on dose distribution is given for a plane defined by the central ray and the major or minor axis of the square or rectangular treatment field being considered, the normal display being in the form of isodose curves. An improved design for an automatic isodose plotter is described where the radiation detector follows each isodose line in turn with degrees of freedom related to polar coordinate form. Results for 10 MV X-ray beams at 100 SSD as central axis depth dose curves in water for a 20 cm square field from an isodose plot were compared with those derived by computer analysis of tissue-air ratio measurements, and the readings were found to agree to 0.5% of the maximum value. Typical isodose curves drawn by the plotter are also given. The size of the graphite ion chamber used (6 mm internal diameter, 10 mm long) is adequate to obtain isodose curves for ^{60}Co treatment plants, where the source is considerably larger than the ion chamber, but errors are introduced in isodose curves from a linear accelerator by the artificial penumbra as this source diameter is only about 2 mm. A small silicon diode (effective diameter 1.3 mm) should give more accurate isodose curves, but the performance of these silicon diodes may be unreliable. Isodose curves produced by the plotter were therefore modified by computer analysis to overcome this source of error. (UK)

742 RESPONSE OF ^{6}LiF:Mg AND ^{7}LiF:Mg THERMOLUMINESCENT DOSIMETERS TO FAST NEUTRONS. Alexander, A. J. Manhattan, KS; Kansas State Univ. (1974). 146p. University Microfilms Order No. 75-14,350.

Thesis (Ph. D.).

The thermoluminescent response for ^{6}LiF:Mg and ^{7}LiF:Mg dosimeters, measured by the 190°C peak in the glow curve, as a function of neutron energy was experimentally determined. The neutron energy range studied was from 2 MeV to 20 MeV using the LASL 8 MeV vertical Van de Graaff and the LASL proton recoil telescope. Data points were taken every half MeV between 2 MeV and 8 MeV and two data points were taken at 20 MeV. A comparison of other experimental data is also made. Kerma calculations were done for the following neutron reactions: $^{6}Li(n,\alpha)^{3}T$, $^{6}Li(n,n)^{6}Li$, $^{6}Li(n,n'\alpha)^{2}D$, $^{7}Li(n,n)^{7}Li$, $^{7}Li(n,n'\alpha)^{3}T$, $^{19}F(n,\alpha)^{16}N$, and $^{19}F(n,n)^{19}F$. It was assumed that the thermoluminescence is directly proportional to the energy deposited by these various reactions. Weighted least squares fits of the partial kermas to the experimental thermoluminescent response curves as a function of neutron energy were used to determine the proportionality constants. (WHK)

743 PAINT COMPOSITIONS FOR INDICATING IRRADIATION DOSE. Maruyama, T.; Murata, K. (to Kansai Paint Co., Ltd.). US Patent 3,907,732. 23 Sep 1975. Priority date 18 Feb 1970, Japan. 12p.

Paint compositions for indicating irradiation dose are prepared from chlorine-combined polyester, 5 to 30 percent by weight of a reductive discoloring substance or a mixture of said substances, and/or 0.005 to 2.0 percent by weight of a reducing dyestuff or a mixture of said dyestuffs, in which said chlorine-combined polyester is obtained by a chlorinated dibasic acid or its anhydride as an acid component or a part of an acid component selected from a group consisting of 3-chlorophthalic acid, 4-chlorophthalic acid, dichlorinated phthalic acid, tetrachlorophthalic acid, 1,4,5,6,7,7-hexachlorobicyclo-(2,2,1)-5-heptene-2,3-dicarboxylic acid, 4-chloro-4-cyclohexene-1,2-dicarboxylic acid and the anhydrides corresponding to said acids. (auth)

744 LAMINATED DOSIMETRIC CARD. Cox, F. M.; Chamberlain, J. D.; Shrader, E. F.; Shoffner, B. M.; Szalanczy, A. (to Kewanee Oil Co.). US Patent 3,894,238. 8 Jul 1975. Filed date 5 Dec 1973. 8p.

A laminated card with one or more apertures, each adapted to peripherally seal an encapsulated dosimeter, is formed by bonding a foraminous, code-adaptable, rigid sheet of low-Z material with a codedly transparent sheet of low-Z material in light-transmitting registry with particular code-holes of the rigid sheet. The laminated card may be coded to identify the person carrying it, and/or the location or circumstances related to its exposure to radiation. This card is particularly adapted for use in an instrument capable of evaluating a multiplicity of cards, substantially continuously. The coded identification from the card may be displayed by an appropriate machine, and if desired an evaluation may be recorded because of a "parity checking" system incorporated in each card, which permits "auto-correction." Alternatively, where means for effecting the correction automatically are available, the operation of the machine may be interrupted to permit visual examination of a rejected card. The card of this invention is also coded for identifying the type of card with respect to its specific function, and whether or not a card is correctly positioned at any predetermined location during its sequential progress through the instrument in which it is evaluated. Dosimeters are evaluated and the card identified in one pass through the instrument. (auth)

745 DOSIMETER TO BE WORN ON A FINGER. Burgkhardt, B.; Piesch, E.; Schrodt, H.; Buijs, K.; Vaane, J. P. (to Gesellschaft fuer Kernforschung mbH). US Patent 3,878,108. 15 Apr 1975. Priority date 14 Jun 1972, F. R. Germany. 6p.

For the purpose of accurately measuring the radioactive radiation to which the hand of a person is exposed, there is provided a dosimeter that includes a casing having an arcuate shape conforming to the circumferential contour of a person's finger. In the casing there is situated a stack of foils including at least one fission foil and at least one detector foil for detecting fission fragments leaving the fission foil. (auth)

746 SYSTEM AND METHOD FOR ADMINISTERING RADIATION. Vogel, T. M. (to Varian Associates). US Patent 3,906,233. 16 Sep 1975. Filed date 12 Oct 1973. 18p.

A system and method for metering the quantity of radiation administered a subject by a source of radiation movable along a path relative to the subject is described. The system cumulatively counts the amount of radiation directed toward the subject during each of a succession of increments of motion of the source. When a predetermined amount of radiation is delivered during an increment, the source is disabled until the source passes into the next increment of displacement. The count of radiation is restarted at the instant the source is disabled, to accumulate accurately any added spurious radiation dosage which may occur and to include that dosage in the count of the permitted amount for the next succeeding increment of motion. Several interlocks for disabling the system in response to various malfunctions are included. Means for controlling the speed of movement of the source and/or the dose rate of the source are also included. (auth)

Nuclear Spectroscopic Instrumentation

Refer also to abstracts 830, 1483, 1484, and 2183.

747 (BLG-501) ANALYSIS OF THE MEASUREMENT PROCEDURE AND OF IMPORTANT EXPERIMENTAL PARAMETERS IN THE LITHIUM-6 SPECTROMETRY TECHNIQUE. De Leeuw-Gierts, G.; De Leeuw, S. (Centre d'Etude de l'Energie

Nucleaire, Brussels (Belgium)). Apr 1975. 45p. Dep. NTIS (US Sales Only) $5.25.

Important characterisitcs of the ^{6}Li spectrometry technique, including the E_t and $E_\alpha + E_t$ parameter, are investigated. After a short description of the fundamentals necessary before applying the technique, attention is drawn to the parameters to be carefully determined before and during the measurement. Sensitivity tests on some of these parameters are illustrated. Finally the neutron spectrum, measured between ~5 keV and 7 MeV, is compared with the theoretical spectrum. (auth)

748 (CONF-750648-2) GAMMA-RAY ENERGIES FOR CALIBRATION OF Ge(Li) SPECTROMETERS. Helmer, R. G.; Greenwood, R. C.; Gehrke, R. J. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA). Idaho National Engineering Lab.). 1975. 7p. Dep. NTIS $4.50.

From 5th international conference on atomic masses and fundamental constants; Paris, France (2 Jun 1975).

Gamma-ray energies are compared for bent-crystal measurements, Ge(Li) measurements, and other measurements. 150 gamma-ray energies below 3450 keV from 35 isotopes are being calibrated for calibration of Ge(Li) spectrometers. (WHK)

749 (INIS-mf-1698, pp 203-212) FAST NEUTRON TIME-OF-FLIGHT SPECTROMETER WITH THE E1-5 NANOSECOND PULSED SOURCE. Zhuk, V. V.; Kozyr, A. A.; Korzh, I. A.; Mishchenko, V. A.; Mozhzukhin, E. N.; Nazarov, N. S.; Pasechnik, M. V.; Podobailo, V. S.; Pravdivyi, N. M.; Sanzhur, I. E.; Totskii, I. A. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

This study describes the construction and operating principle of a pulsed ion source from a 5 MeV electrostatic generator, and the fast neutron, time-of-flight spectrometer created from this generator. The following parameters were obtained for ion pulses on an accelerator target: pulse current of 1 to 1.5 nsec, and tracing frequency of 4 mhz. The time resolution of the spectrometer, which was determined from the time spectrum of gamma rays emitted by a titanium-tritium target bombarded by protons, was 2.3 nsec. The integral and differential nonlinearity in the region of 250 nsec was at least 0.25% and 4% respectively. The time-of-flight base of the spectrometer was 1.5 to 2.8 m. (tr-SJR)

750 (INIS-mf-1698, pp 300-311) MEASUREMENT AND PROCESSING OF NEUTRON SPECTRA IN WIDE ENERGY RANGE WITH THE AID OF IONIZATION SPECTROMETER. Baikalov, S. N.; Egorov, Yu. A.; Sharkov, V. P.; Korolev, V. S.; Kravchuk, V. G.; Chubinskii, V. V. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

This work presents the results on measuring neutron fields by means of the commercial neutron spectrometer SEN2-02. A brief description is presented of a spectrometer which uses proportional counters SNM-41 that utilize the nuclear reaction $He^3(n,p)T$ and counters of recoil nuclei SNM-38, SNM-39 and SNM-40. A look is taken at the technique of obtaining the initial energy spectrum from the experimental data. (tr-SJR)

751 (INIS-mf-1698, pp 339-343) MEASUREMENTS OF ABSOLUTE EFFICIENCY OF A TIME-OF-FLIGHT NEUTRON SPECTROMETER. Plyaskin, V. I.; Sal'nikov, O. A.; Trykova, V. I. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A description is given of a method of measuring the absolute efficiency of a fast neutron, scintillation-spectrometer by a time-of-flight method. In order to measure the absolute flux, use is made of a single-crystal spectrometer having thin crystals of stilbene. The absolute efficiency of the detector was measured over the range from 0.4 to 6.2 MeV with an accuracy of ±4%. (tr-SJR)

752 (KFK-2200, pp 97-148) SPECTROMETRY OF FAST NEUTRONS IN REACTOR PHYSICS AND NUCLEAR ENGINEERING. Bluhm, H.; Fieg, G.; Kappler, F.; Rusch, D.; Werle, H. Apr 1975. (In German).

In contributions to nuclear engineering.

Following the discussion of the measuring methods (4π-recoil protons proportional counter, sandwich spectrometer, time-of-flight method), measurements of fission neutron spectra and uranium sphere transmission as well as cross section determinations on single material arrangements (U-238, iron, lithium) are explained as examples of application. (GE)

753 (UCRL-76869) DIRECT X-RAY RESPONSE OF SELF-SCANNING PHOTODIODE ARRAYS. Koppel, L. N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 13 Aug 1975. 12p. (CONF-750831-3). Dep. NTIS $4.00.

From 24th annual conference on applications of x-ray analysis; Denver, Colorado, USA (6 Aug 1975).

Self-scanning photodiode arrays were tested for their ability to measure the spatial distribution of low-energy x rays in a wavelength-dispersive spectrometer. X-ray spectral sensitivity was measured with a calibrated dc source of nearly-monochromatic characteristic-x rays with photon energies in the range of 1.5 to 8 keV. Photodiode response was found to be linear with x-ray flux. Exposure to large doses of copper radiation did not affect sensitivity. A mathematical model that describes the experimental data is presented. It was found that spatial resolving power was lowered by the dispersal of photogenerated charges. This effect was investigated with collimated beams and is described with a formula that predicts the loss of diode signals. (auth)

754 SIMULTANEOUS β,γ-COINCIDENCE SPECTROSCOPY OF SEVERAL SAMPLES. Niese, S.; Kleeberg, H. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Isotopenpraxis; 11: No. 4, 125-127(Apr 1975). (In German).

In an arrangement for simultaneous $\beta\gamma$-coincidence spectroscopy of several samples and of the background a large scintillation detector is used for the measurement of the γ-rays and several small detectors are used for detection of the β-rays. The background of the device is very small and the counting capacity is high. The cross talk coefficients depending on the energy of β-rays and in the case of γ,γ cascades on the energy of the γ-rays, too, covers values of 0.3 and 2‰. (auth)

755 INCLUSION OF SERVICING INFORMATION ON PHOTOGRAPHIC FILM DESIGNED FOR AUTOMATIC HANDLING. Andreev, E. M.; Vasilevskii, I. M.; Moiseenkov, V. A.; Nguen Man' Shat; Sinaev, A. N.; Stakin, A. A.; Frolov, N. S. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech.; 18: No. 1, 82-85(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 78-81(1975).

A system is described for including servicing information on photographic film which has been developed for a magnetic spark spectrometer designed for experiments on the proton synchrotron at the Institute of High Energy Physics. The system satisfies the requirements adopted at the Joint Institute of Nuclear Research governing the arrangement of information on photographs which are to be handled on automatic instruments. Special attention is devoted to the speed of response of the system and to the reliability of its prolonged operation. Automatic monitoring of correct operation is provided for those sections of the device whose failure makes automatic handling of the film impossible. (auth)

756 HIGH-SPEED LOGIC CIRCUITS FOR MULTICHANNEL CHARGED-PARTICLE COUNTERS. Nemashkalo, A. A.; Denyak, V. M. (Kharkov Physicotechnical Inst.). Instrum. Exp. Tech.; 18: No. 1, 99-102(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 92-95(1975).

A multichannel nanosecond logic circuit is described, designed for use with scintillation and Cherenkov charged-particle detectors. Use of integrated circuits significantly increases the number of channels and expands the possible logic operations within a channel. (auth)

757 SHAPER OF A ONE-CRYSTAL SCINTILLATION SPECTROMETER WITH A HIGH LOAD CAPACITY. Novisov, B. S.; Kosse, A. I.; Pulin, D. A.; Maksimenko, A. S. (Ural Polytechnic Inst., Sverdlovsk, USSR). Instrum. Exp. Tech.; 18: No. 1, 75-78(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 72-75(1975).

The spectrometric-signal shaper of a scintillation γ spectrometer containing a NaI(Tl) crystal is considered; it enables measurements to be made with an accuracy of 0.1% at a count rate of 10^3-10^5 pulses/sec. The shaper uses a controlled load incorporated into the anode circuit of the photomultiplier. The dead time of the shaper does not depend on the energy spectrum of the γ radiation being recorded or the count rates in the measuring tract. (auth)

758 SPECTROMETER FOR INTENSE ELECTRON BEAMS. Dergobuzov, K. A.; Evdokimov, O. B.; Kononov, B. A.; Yagushkin, N. I. (Tomsk Polytechnic Inst., USSR). Instrum. Exp. Tech.; 18: No. 1, 23-24(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 29-30(1975).

A spectrometer is described which is simple in construction and is intended for measuring continuous spectra of intense electron sources with 20% error. (auth)

759 CHERENKOV SPECTROMETER WITH A WATER RADIATOR. Ganichev, V. I.; Kruglov, V. V.; Kulikov, A. V.; Kuptsov, A. V.; Nemenov, L. L. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech.; 18: No. 1, 25-27 (1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 31-33(1975).

A Cherenkov spectrometer with a water radiator is described; it is designed for measuring electron energies in the range 20 to 120 MeV. (auth)

760 USE OF ELECTRONIC ANGULAR COLLIMATION FOR THE STUDY OF (n,α) REACTIONS. Rodionov, K. G.; Rumi, R. F.; Tishin, V. G. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech.; 18: No. 1, 28-31(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 33-37(1975).

The paper describes a scheme for the electronic collimation of α particles in an ionization chamber. The system is included in a multiparametric analysis equipment, designed for the study of (n, α) reactions. The equipment enables data to be obtained on the spectra of α particles over a large range of energies. The tails from the low-energy side are eliminated and the resolution is improved. (auth)

761 INFLUENCE OF THE ABSORPTION LOCUS OF γ-QUANTOR ON THE ENERGY RESOLUTION OF DIFFUSED SEMICONDUCTOR DETECTORS WITH INTERNAL MULTIPLICATION. Heuberger, A. Munich; Technische Univ. (1973). 111p. (In German). INIS.

Thesis.

The noise contribution is determined which is generated by the incomplete collection, as a result of structure, and locally different multiplication of the primary charge carriers as a consequence of the difference in the ionization coefficients of electrons and holes. This contribution is a function only of the structure and the geometry of the multiplying detector. First of all, the most important criteria are discussed which, in general terms, affect the usefulness of a diode structure as a multiplying detector, namely the counting volume, breakdown behavior, homogeneity of multiplication, etc. On the basis of these considerations, four specific structures are calculated: Ga-diffused p^+n diodes (structure I); p-diffused n^+p structures (structure II); planar $n^+\pi p^+$ punch-through diodes (structure III); $n^+p\pi p^+$ read structure (structure IV). With the drift zone optimally etched, the ratio between the width of the nonmultiplying p-space charge zone and the remaining space charge zone is the decisive parameter governing the signal-to-noise ratio (SNR) from the two variation contributions considered. The best SNR values are furnished by structure IV while structure I, because of the insufficient p-width, is completely unsuited to radiation detection proportional to energy. However, it must also be doubted whether detectors of structure IV will become significant for practical purposes of gamma spectroscopy at room temperature in the light of the data presently technically attainable, with respect to the other noise contributions. But all the diodes considered can be used for intensity-proportional light detection. (auth)

762 4π-β-γ-COINCIDENCE SPECTROMETER WITH Si(Li)- AND NaI(Tl)-DETECTORS. Measurement of β-Spectra from the Decay of ^{90}Y, ^{91}Y and ^{139}Ba. Flothmann, D. Heidelberg; Heidelberg Univ. (1972). 64p. (In German). INIS.

Thesis.

To allow the β-spectroscopy method using solid state detectors to be expanded from pure ground state transitions to internal β-transitions and positron decays, a 4π β-γ coincidence spectrometer was built. The characteristics of the spectrometer were studied in addition by means of measurements of monoenergetic electrons in coincidence with the characteristic X-radiation. The findings obtained in this way and the results from spectrum measurements on ^{22}Na and ^{24}Na show that the quality of the spectrometer compares well with that of magnetic spectrometers, but that the solid state spectrometer offers advantages when measuring decays of short half-lives. (auth)

763 TRANSVERSAL FILTERS FOR PULSE SPECTROSCOPY. Miller, G. L.; Robinson, D. A. H. (Bell Telephone Labs., Murray Hill, NJ). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2022-2032(Oct 1975).

Transversal filtering consists of forming an output signal from the suitably weighted sum of successively delayed samples of a given input waveform. Although such filters exhibit many attractive features, economic considerations have previously limited their hardware implementation to rather few areas, primarily the fields of communications and radar. However, recent technological developments have significantly reduced the cost of the multiple tapped-delay operations that are required in such filters, thereby greatly expanding their potential areas of application. The purpose of the present paper is two-fold, first to serve as a general introduction to the possibilities of transversal filters for the processing of isolated randomly distributed pulses (such as occur in experimental nuclear physics), and second to introduce a new implementation of such filters in the form of capacitively tapped delay lines. This latter form of transversal filter is readily fabricated and is well suited for operation on pulses in the few nanosecond to few microsecond time range. (auth)

764 ACCURATE MEASUREMENT OF NOISE PARAMETERS IN ULTRA-LOW NOISE OPTO-FEEDBACK SPECTROMETER SYSTEMS. Llacer, J. (Univ. of California, Berkeley). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2033-2052(Oct 1975).

The accurate measurement of the basic noise parameters of ultra-low noise spectrometer systems has been developed in the frequency domain by spectrum analysis. This method overcomes some of the difficulties experienced in using conventional techniques. An analytic and experimental comparison between "time" and frequency domain techniques is carried out and the use of the latter as a method to develop extremely low-noise detector and FET packages is demonstrated. The origin of the remaining noise in high quality systems is traced to surface and gate junction generation through traps in the FET. (auth)

765 PULSE PROCESSOR FOR X-RAY SPECTROMETRY WITH Si(Li)-DETECTORS. Kandiah, K.; Smith, A. J.; White, G. (United Kingdom Atomic Energy Authority, Harwell, Eng.). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22, No. 5, 2058-2065(Oct 1975).

The general feature of a pulse processor for use with opto-electronic charge sensitive head amplifiers particularly with Si(Li) X-ray detectors are described. The instrument contains time-variant filters with direct coupled amplifiers and comprehensive pile-up protection and live time correction. The test results indicate that the system can cope with an extremely wide range of signal processing times, counting rates and changes of spectral content without any appreciable degradation in energy resolution and with useful output rates for input rates up to well over 50,000 events/sec. (auth)

766 MICROPROCESSOR-BASED CAMAC DATA ACQUISITION AND PROCESSING SYSTEM. Coppo, N.; De Grandi, G.; Montagni, M.; Stanchi, L. (EURATOM Joint Research Center, Ispra, Italy). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2078-2083(Oct 1975).

The peculiar characteristics of an autonomous CAMAC system based on the use of an Intel 8080 microprocessor are described. The system memory for program store, scratch work and data acquisition is contained in the autonomous CAMAC controller. Memory can be accessed in DMA mode with 24-bit data utilizing three bytes with a unique address. Suitable 3-byte floating point mathematical subroutines have been developed for general use and in particular for the requirements of the system. Details on hardware and software of the system are illustrated together with a brief mention of the generalizations. (auth)

High Energy Physics Instrumentation

Refer also to abstract 1456.

767 (CERN-Trans-75-5) XTR-DETECTOR FOR HADRON IDENTIFICATION IN THE (30 TO 300) GeV/c MOMENTUM RANGE. Kazaryan, S. P.; Kankanyan, S. A.; Oganesyan, A. G.; Tamanyan, A. G. (Erevanskij Fizicheskij Inst. (USSR)). 1975. Translated by R. Luther from EFI-103(75). 13p. Dep. NTIS (US Sales Only) $4.50.

A new type of XTR-detector is proposed which allows pions to be separated from kaons and protons at relatively low $\gamma = E/mc^2$ values, viz in the (30 to 300) GeV/c momentum range. Particles are identified in this momentum region by making maximum use of the low-energy part ($\hbar\omega \lesssim 5$ keV) of the XTR spectrum. (auth)

768 (JINR-P1-9134) DESIGNING AND PRODUCING AUTOMATIZATION OF WIRE CHAMBERS PRINTED ELECTRODES. Pakhomov, V. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1975. 10p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

A question is considered about the designing (with computer) and producing (with tape-controlled machine) of printed electrodes of wire chambers (spark, drift, proportional). The programs in FORTRAN for the BESM-6 computer make it possible to compute the printed circuit of an electrode from the initial data defining its construction, and to obtain the plot at a plotter and controlled punch tapes for the machine ADMAP. (auth)

769 (JINR-P13-9131) LOCALIZATION OF CHARGED PARTICLE TRACKS IN A SELF-SHUNTED HELIUM STREAMER CHAMBER. Busso, L.; Kulyukin, M. M.; Lozanskii, E. D.; Lyashenko, V. I.; Nguen Min Kao; Piradzhino, G.; Pontekorvo, D. B.; Troshev, T. M.; Falomkin, I. V.; Shcherbakov, Yu. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1975. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

A helium filled self-shunted streamer chamber with various admixtures (CH_4, H_2, Xe, α-pinene, Ne, H_2O) is described. Operating conditions have been investigated. An explanation is presented for the mechanism of the track localization. (auth)

770 (LBL-4221) CYLINDRICAL GEOMETRY FOR PROPORTIONAL AND DRIFT CHAMBERS. Sadoulet, B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1975. Contract W-7405-ENG-48. 17p. (CONF-750684-2). Dep. NTIS $4.00.

From international meeting on proportional and drift chambers; Dubna, USSR (20 Jun 1975).

For experiments performed around storage rings such as e^+e^- rings or the ISR pp rings, cylindrical wire chambers are very attractive. They surround the beam pipe completely without any dead region in the azimuth, and fit well with the geometry of events where particles are more or less spherically produced. Unfortunately, cylindrical proportional or drift chambers are difficult to make. Problems are discussed and two approaches to fabricating the cathodes are discussed. (WHK)

771 DRIFT CHAMBER FOR THE REGISTRATION OF STRONGLY IONIZING PARTICLES. Markaryan, E.R.; Mkrtchyan, G.G.; Petrosyan, O.P.; Pikhtelev, R.N. JETP Lett. 21: No. 8, 237-238 (20 Apr 1975).

We investigate a drift chamber filled with the mixture He^4+CO_2 or He^4+CH_4, intended for the registration of strongly ionizing particles. The chamber has high coordinate and time resolution ($\sigma_x \lesssim 0.2$ mm, $\Delta t \simeq 80$ nsec). The electron drift velocities were measured for the mixtures He^4+(5, 10, 20, 30) % CH_4 and He^4+(5, 10, 20, 30) % CO_2. It is shown that if the chamber is filled with He^4+CH_4 the registration efficiency is ~ 100% over the entire width of the drift gap. (auth)

772 INTEGRATED CIRCUIT COUNTER FOR COSMIC RAY EXPERIMENTS. Gould, C.R.; Ives, R.L. (Physics Department, North Carolina State University, Raleigh, North Carolina 27607). Am. J. Phys. 43: No. 10, 918-920 (Oct 1975).

An inexpensive cosmic ray detection system is described that consists of two Geiger counters and an integrated circuit scaler. A measurement of the azimuthal variation in the intensity of cosmic rays is discussed as an example of the type of experiment that can be performed with this arrangement. (auth)

773 METHOD OF DETERMINING THE CHARACTERISTICS OF A GAMMA TELESCOPE. Iyudin, A. F.; Luchkov, B. I.; Ozerov, Yu. V.; Rogov, E. V. (Moscow Engineering-Physics Inst.). Instrum. Exp. Tech.; 18: No. 1, 47-50(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 48-51(1975).

A method is proposed for determining the characteristics of a γ telescope, which is based on calculating them by the Monte Carlo method with the introduction of free parameters; the values of these parameters are determined by comparing a small number of principal characteristics of the instrument which are obtained by calculation with those measured for calibration using electrons. (auth)

774 SUPPLYING A SHOWER SPARK CHAMBER FROM A POWERFUL PULSE GENERATOR. Sterligov, A. G.; Usov, Yu. P. (Tomsk Polytechnic Inst., USSR). Instrum. Exp. Tech.; 18: No. 1, 57-59(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 56-59(1975).

A description is given of a shower spark chamber whose electrodes are connected in parallel and are supplied from a generator producing pulses of fixed length and having a wave impedance of 2.5Ω. A chamber shower efficiency of approximately 100% is achieved. The results obtained are discussed. (auth)

775 CATHODE-RAY-TUBE AUTOMATON FOR HANDLING FILM INFORMATION. Kryutchenko, E. V.; Kuchin, Yu. M.; Rabin, B. M.; Utochkin, B. A. (Inst. of High-Energy Physics, Serpukhov, USSR). Instrum. Exp. Tech.; 18: No. 1, 41-43(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 44-46(1975).

An "Iskra" cathode-ray-tube automaton [1] with a controllable light spot is described which is designed for measurement of photographs from spark and streamer chambers. The process of handling the photographs is controlled by an electronic computer. The automaton is equipped with a light-pencil display. The main characteristics of the automaton are frame size 36 × 24 mm; diameter of the light spot 30 μ; mean-square error of measuring the coordinates 7 μ. The coordinates, width, and optical density of the objects on the photograph are measured. The automaton also allows the reverse problem to be solved—i.e., the extraction of information from the electronic computer onto the unexposed photographic film. (auth)

776 INCREASING THE SPEED OF RESPONSE OF TELEVISION COMPLEXES FOR FILMLESS RETRIEVAL OF INFORMATION FROM SPARK CHAMBERS. Gorokhov, V. P.; Ershov, I. V.; Petrakov, A. V. (All-Union Correspondence Electrical-Engineering Inst. of Communication, Moscow). Instrum. Exp. Tech.; 18: No. 1, 46-48(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 46-48(1975).

An analysis is performed of the speed of response of vidicon complexes for filmless retrieval of information from spark chambers; the inertial characteristics of plumbicons are presented in a microsecond intensity-gating regime; it is shown that the use of plumbicons increases the rate of acquisition of statistical data by a factor of 3 to 4 for takeoff of information from spark chambers. (auth)

777 DEVELOPMENT OF A SPARK CHAMBER EXPERIMENT FOR γ-ASTRONOMY AND MEASUREMENT OF COSMIC γ-RAYS DURING A BALLOON FLIGHT ON JUNE 15TH, 1970. Rothermel, H. Munich; Technische Univ. (1973). 92p. (In German). INIS.

Thesis.

Gamma converter design, method of measurement and mode of operation of the wire spark chamber and the read-out electronics of the magnetic-core memory are described. With this measuring equipment, the extraterrestrial component of the gamma radiation was measured in the stratosphere for the first time in the range from 10 to 100 MeV. The angle of impact of the photons did not have any correlation with the Milky Way. (GE)

Radiometric Instruments

Refer also to abstracts 47, 783, and 1199.

778 (LBL-4402) APPLICATION OF A LOW ENERGY X-RAY SPECTROMETER TO ANALYSES OF SUSPENDED AIR PARTICULATE MATTER. Giauque, R. D.; Garrett, R. B.; Goda, L. Y.; Jaklevic, J. M.; Malone, D. F. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 12 Sep 1975. Contract W-7405-ENG-48. 18p. (CONF-750831-5). Dep. NTIS $4.00.

From 24th annual conference on applications of x-ray analysis; Denver, Colorado, USA (6 Aug 1975).

A semiconductor detector x-ray spectrometer has been constructed for the analysis of elements in air particulate specimens. The excitation radiation is provided, either directly or indirectly, using a low power (40 watts) Ag anode x-ray tube. Less than 100 ng for most of the elements in the range Mg yields Zr, Pb are easily detected within two 1-minute counting intervals. A calibration technique for light element analysis and an experimental method which compensates for particle size effects are discussed. (auth)

779 (PB-239051) COMPACTION OF ASPHALT CONCRETE PAVEMENTS. Final Report. Cechetini, J. A.; Sherman, G. B. (California State Div. of Highways, Sacramento (USA)). Feb 1974. 40p. NTIS $3.75.

The research project was initiated in order to study the compaction of asphalt concrete pavements. It was determined that adequate densities were not being obtained with the California Standard Specifications and new Standard Special Provisions were written. A rolling procedure was developed for both thick-lift and thin-lift construction. Measurements were made of recently constructed pavements to determine the riding qualities associated with the various construction methods using different lift thicknesses. Research was also conducted on the use of nuclear gages to determine asphalt concrete densities and a method was written for the use of nuclear gages in conjunction with the qualification of rollers. (GRA)

780 DETERMINATION OF CERTAIN PARAMETERS OF BURDEN CHARGE AREA USING RADIOMETRIC GAGE. Gudenko, V. N. Stal; No. 8, 682-686(Aug 1974). (In Russian).

For English translation of selected articles see the journal Stal USSR.

From the profile of the charge along a diameter (5.8 m) of a blast furnace column it is possible to measure the slope after delivery of the charge (hopper shape determined) and the densification of the material after delivery to the furnace, analyze the spread of the descent rate of the surface layer of the charge along the diameter as a whole and for intervals, and determine the channel course if a channel forms. The most typical profiles are shown which illustrate surface layer changes, and the cyclic

nature of changes in parameters between charges is demonstrated. An increase in the rate of descent of the peripheral zone is usually accompanied by a decrease in the axial zone. (tr-auth)

781 EXPERIMENTAL USAGE OF BETA-RADIOMETRIC GAGE OF GALVANIZING UNIT TO CONTROL COATING THICKNESS. Bogachev, A. M.; Bulatov, Yu. I.; Rubinshtejn, L. A.; Rynnov, N. I. Stal; No. 9, 827(Sep 1974). (In Russian).

For English translation see the journal Stal USSR.

In a group of heated galvanized steel bands at the Chernovensk metallurgy plant in 1970 a low-inertia radioisotopic thickness gage was used for measuring the zinc coating. The beta source was $^{90}Sr + ^{90}Y$. Thicknesses of 20 to 25 μm were measured with a precision of ±2 μm. The block diagram is described briefly. For increasing the precision, automatic corrections were made regularly. Temperature was stabilized by an air stream. The equipment can be used for automatic monitoring of coating thickness from both sides of the band. (tr-auth)

782 AUTOMATIC SYSTEM FOR NEUTRON ACTIVATION ANALYSIS OF GEOLOGIC SAMPLES. Rudenko, A. K.; Zdesenko, Yu. G.; Samoded, A. A. (AN Ukrainskoj SSR, Kiev. Inst. Geokhimii i Fiziki Mineralov). pp 168-171 of Problems of Geochemistry, Mineralogy, Petrology and Ore Formation. Keiv; Naukova Dumka (1974). (In Russian)

The systems considered consist of a neutron generator with a remote control block; transport apparatus; measurement circuit consisting of detectors, pulse-amplitude analyzer and equipment for information output; and automatic block ensuring completion of the analysis program. (tr-auth)

783 APPLICATION OF NEUTRON-NEUTRON METHODS TO DETERMINATION OF CARBONATE ROCK POROSITY. Kapkanshchikova, I. A.: Lakhnyuk, V. M.; Ovseenko, G. I. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Neftedobyvayushchej Promyshlennosti, Kiev (Ukrainian SSR)). pp No. 11-12 p. 153-157 of Exploitation of Oil Fields. Moscow; Nedra (1973). (In Russian)

2 refs.; 2 figs.

In the productive carbonates of the Davydkov and Vishan sedimentary deposits it was shown that neutron-neutron logging methods may be used both as independent methods for determining porosity (total and open) and as a control method for neutron-gamma determination of porosity. (tr-auth)

784 IN-SITU ASSAYING FOR URANIUM IN ROCK FORMATIONS USING NEUTRON SOURCE. Givens, W. W.; Caldwell, R. L.; Mills, W. R. (to Mobil Oil Southern Africa (Pty) Ltd., Cape Town (South Africa)). South African Patent Document 72/3724/D/. 30 May 1972. 20p.

Available from Patents office, Struben Street, Pretoria.

A method of assaying for uranium in the formations traversed by a borehole is described which comprises: locating a pulsed neutron source and a neutron detector in a borehole at the level of a formation of interest suspected of containing uranium, operating the neutron source cyclically with the time between each neutron burst being sufficient to allow neutrons from the source to disappear but being long enough to allow the delayed neutrons resulting from the neutron fission of uranium to appear at the detector, detecting neutrons with the detector, as a result of the irradiation of the formations with the neutrons from the source, and obtaining measurements of the quantity of neutrons detected between neutron bursts only at a time period when neutrons from the source have disappeared but while delayed fission neutrons from uranium may be emitted. (INIS)

785 MEASURING OF LIQUID METALS DENSITY BY MEANS OF GAMMA RADIATION. Yavojskij, V. I.; Ezhov, A. A.; Kravchenko, V. F.; Uskov, V. S.; Nebosov, Yu. I.; Chernov, Yu. A.; Dorofeev, G. A. Izv. Akad. Nauk SSSR, Metal.; No. 4, 61-66(Jul 1974). (In Russian).

For English translation see the journal Russ. Metall.

The purpose of the study is to create a unit for the rapid (not more than 20 sec) measurement of the density of liquid metals and alloys with sufficiently high accuracy by the use of penetrating radiation. Measurements of liquid metal density at high temperatures were carried out with the use of a gamma source (radioactive Cs-137) by comparing the absorption of gamma quanta in the melt under study and in a standard sample whose density at room temperature had been determined by hydrostatic suspension. Possible errors were determined in measuring metal density, errors which occur because of sample curvature, a change in composition of the metal under study, scattered radiation and others. The measurements are sufficiently accurate (relative error of 0.2%). The temperature dependencies of the density of copper and iron were determined at temperatures from the melting point to 1600 and 1720°C respectively; the change in specific volume of these metals was also determined at the crystallization point. (tr-SJR)

786 FREQUENCY-PROGRAMMED ELECTRON-CAPTURE DETECTOR. Marshall, J. H. III; Harrington, T. A. (to MDH Industries, Inc.). US Patent 3,897,344. 29 Jul 1975. Filed Date 31 Jul 1974. 18p.

Improved system of circuitry for increasing the sensitivity of a frequency-programmed electron-capture detector over a wide range of detector operation reduces the variation in the speed of response with sample concentration and includes a limit detector, delay circuit and counter to select by mostly inexpensive digital means the proper frequency of pulses which are applied to the detector. The electron-capture detector operated as part of this system produces a signal responsive to concentrations of predetermined compounds, such as gases, in the form of a pulse frequency which will vary directly with the concentration of the sampled compound in that detector. Common frequency-to-voltage conversion devices or digital counting techniques can be used as a means for indicating the level of such concentrations. (auth)

787 ISOTOPE SAND MEASURING INSTRUMENT EMBODYING THE ABSORPTION PRINCIPLE. Ch'ing Hua Ta Hsueh Hsueh Pao; No. 1, 111-116(Jan 1973). (In Chinese).

Since sand and pure water both absorb gamma rays, by comparing the gamma ray absorption of clear and turbid water, one can derive absorption by sand from an empirical curve. This in turn can lead to the sand content in water. The instrument for sand measurement comprises a detecting head and a counter. The detecting head is composed of a radiation source and a scintillation detector. The scintillation detector is made up of sodium iodide crystals, a photomultiplier tube, and an emitter tracer, which are installed in an aluminum alloy tube connected to a 600-m signal cable. The counter is transistorized, of the printed-circuit board modular type. The instrument measured the sand content in the Yellow River, downstream from the San-men Gorge Dam. The result was quite accurate. (JPRS)

788 MEASURING APPARATUS. Schuster, N. A. (to Schlumberger Ltd.). US Patent 3,887,805. 3 Jun 1975. Filed date 16 Apr 1973. 10p.

An illustrative embodiment of the invention discloses a borehole effects compensation technique for a neutron logging tool. A third neutron detector (or its physical equivalent) is joined to a two-neutron detector formation porosity logging tool. The third detector equivalent is positioned within the tool a distance relative to the neutron source and the other detectors that enables changes in the signal from the third detector caused by variations in the borehole environment to be generally distinguishable from changes in the signal from at least one of the other detectors. The signals from the third detector and one of the two other detectors are combined in order to compensate for the influence of the borehole environment. (auth)

789 RADIOISOTOPE-EXCITED ENERGY-DISPERSIVE X-RAY FLUORESCENCE APPARATUS. Rhodes, J. R. (to Columbia Scientific Industries, Inc.). US Patent 3,889,113. 10 Jun 1975. Filed date 3 May 1973. 10p.

Radioisotope-excited, energy-dispersive, X-ray fluorescence apparatus for positioning a plurality of disc sources in annular configuration in a helium-filled compartment and about the window of the vacuum cryostat housing the detector is described. The specimen holder leaves the specimen in air and the area and spacing of the specimen, detector and sources are such as to optimize operation about the plateau of the count rate distance curve and to produce an essentially flat detector response profile curve, with a well-defined cutoff. (auth)

790 APPARATUS USING RADIOACTIVE PARTICLES FOR MEASURING GAS TEMPERATURES. Compton, W. A.; Duffy, T. E.; Seegall, M. I. (to International Harvester Co.). US Patent 3,874,238. 1 Apr 1975. Filed date 23 Feb 1973. 26p.

Apparatus for producing a signal indicative of the temperature of a heated gas is described comprising a beta particle source; a beta particle detector which intercepts particles emitted from said source; circuitry for converting the detector output to a signal indicative of the density of the gas; a pressure transducer for generating a signal indicative of the pressure on the gas; and circuitry for dividing the pressure signal by the density signal to produce a signal indicative of the average temperature of the gas along the path between the beta particle source and the beta particle detector. (auth)

791 NUCLEONIC MEASURING APPARATUS. Holben, B. C.; Bach, R. E. (to Industrial Nucleonics Corp.). US Patent 3,875,417. 1 Apr 1975. Filed date 26 Feb 1970. 8p.

A nucleonic measuring instrument is described wherein a housing contains a radiation source and has an aperture controlled by a shutter which is spring loaded to a closed position for confining and shielding the radiation and is movable by a motor to an open position for releasing the radiation, the motor being supplied

with power through a heat sensitive element so that it is deenergized and the shutter closes in response to a predetermined high ambient temperature such as may be caused by a fire, and including an explosive blank cartridge positioned in relation to the shutter guide which explodes in response to a still higher ambient temperature, deforming the guide and thereby locking the shutter in the closed position. (auth)

792 WORKPIECE SHAPE: INSENSITIVE RADIATION GAUGING OF ROD-LIKE MATERIALS. McMullen, J. M.; Sturkol, E. W. (to Industrial Nucleonics Corp.). US Patent 3,879,608. 22 Apr 1975. Filed date 25 Jun 1970. 6p.

Specifically disclosed herein is a method and apparatus whereby a rod-like workpiece such as a cigarette rod is gauged by passing it between a beta radiation source and a radiation detector, and the sensitivity of the instrument to changes in the cross-sectional shape of the rod is minimized by placing a "center blanking bar" made from a substantially "infinite absorber" material in the radiation beam which is incident on the rod, so as to reduce the radiation intensity passing through the center of the rod. (auth)

793 DUAL SPACED EPITHERMAL NEUTRON DETECTOR POROSITY LOGGING WITH AcBe SOURCE. Scott, H. D.; Smith, M. P. (to Texaco Inc.). US Patent 3,906,224. 16 Sep 1975. Filed date 12 Oct 1973. 10p.

An illustrative embodiment of the invention includes method and apparatus for making earth formation porosity measurements in open or cased well boreholes. A relatively high intensity (10^8 neutrons/sec) actinium-beryllium neutron source is used to irradiate earth formations surrounding a well borehole with high energy neutrons. As the high energy neutrons interact with the materials comprising the earth formation their energy is reduced and some having epithermal energy are deflected back into the borehole at spaced distances from the neutron source. Two epithermal energy neutron detectors spaced at different vertical distances from the neutron source and from each other are used to measure the epithermal neutron population at the different distances. The ratio of the counting rates in the two detectors may be interpreted in terms of earth formation porosity by means of a predetermined relationship. (auth)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

794 (AD/A-003509) REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS). Volume III. Final Report, May 1971–July 1974. Horne, W. E.; Greegor, R. B.; Wilkinson, M. C.; Madaras, B. K. (Boeing Co., Seattle, Wash. (USA)). Jul 1974. Contract F33615-71-C-1583. 275p. (D-180-10491-4). NTIS $8.50.

See also report dated Oct 1973, AD-774592.

A technique was developed for the accelerated evaluation of silicon solar cells to be used in extended space missions during which weapons environments may also be encountered. Standard N/P silicon cells, as well as lithium-doped silicon cells, were used as test samples during the development and verification of the evaluation method. The solar cell damage model developed represents a significant advancement for predicting space performance of solar cells. The model is capable of (1) accounting for the shielding of solar arrays, (2) integrating over the space environment for both protons and electrons, (3) calculating defect densities as a function of position inside the solar cell, (4) calculating the output I-V characteristics of solar cells under a solar illumination spectrum, and (5) accounting for annealing in lithium doped P/N solar cells. (GRA)

795 (AD/A-004034) EMP HARDENED CMOS CIRCUITS. Final Report, May–October 1973. Hampel, D.; Stewart, R. G. (RCA Government Communications Systems, Somerville, N. J. (USA). Advanced Communications Lab.). Oct 1973. Contract DAAG39-73-C-0136. 35p. NTIS $3.75.

A survey and testing program has shown that standard CMOS circuits will not survive EMP induced surges of more than 200 volts from a 50-ohm source. However, an analysis of the failure mechanism showed that Bulk CMOS integrated circuits could be readily modified to survive EMP surges of up to 5,000 volts from a 50-ohm source. This new monolithic protection circuit is compatible with existing CMOS processing, and represents an extension of existing networks for static discharge protection. Assuming equal production quantities, the cost of EMP protected circuits in ceramic packages would be only 7% higher than for standard units. A 2 to 1 speed degradation is expected, although this effect could be reduced by increasing output transistor drive capability. (GRA)

796 (AD/A-004151) RADIATION EFFECT ON GaAs INTERFACE. Zuleeg, R.; Lehovec, K. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). Sep 1974. Contract F19628-74-C-0129. 21p. NTIS $3.25.

The C-V and Q-V technique was applied to the study of interface charge distributions of GaAs epitaxial layers grown on semi-insulating substrates. Changes of mobility and free carrier concentration in the epitaxial layer and extending through the interface into the substrate were determined before and after exposure to a neutrons fluence of 1.6×10 to the 15th power n/sq cm and a total dose of ionizing radiation of 10^8 rad (RaAs). Changes at the interface and in the epitaxial layer are correlated with the voltage-current characteristic variations of the GaAs junction field-effect transistors. Effects of neutron irradiation on the transient response to ionizing radiation of discrete junction field-effect transistors was assessed. (GRA)

797 (AD/A-004156) ANALYSIS OF PERFORMANCE OF IR DETECTORS UNDER RADIATION ENVIRONMENTS. Scientific Report No. 2, 1 July 1973–30 June 1974. Leadon, R. E.; Green, B. A.; Berger, R. A.; Cesena, R. A. (Intelcom Rad Tech, San Diego, Calif. (USA)). 24 Jul 1974. Contract F19628-72-C-0349. 74p. (RT-8028-006). NTIS $4.25.

A mathematical computer model has been developed for the transient response of silicon photoconductive IR detectors at low temperatures. Predicted responses are compared to measured time histories resulting from short-pulse Linac excitations. The model is used to predict the response of the detector to single gamma events and to explain the memory effect of a moving IR spot. Future work will use the model to investigate the spontaneous spiking noise of biased photoconductive detectors and the response of photovoltaic detectors. Experimental spiking and photovoltaic detector data are presented for use in these analyses. (GRA)

798 (AD/A-004516) RADIATION EFFECTS IN SEMICONDUCTORS AND SEMICONDUCTOR DEVICES. Vavilov, V. S.; Ukhin, N. A. 19 Nov 1974. Translation of Radiatsionnye Effekty v Poluprovodnikakh i Priborakh, n.p., 1969. 180p. NTIS $7.00.

The present book is intended for a broad segment of readers working in the area of semiconductor physics and electronics, nuclear engineering, and applications of atomic energy and nuclear radiations. Part One (written by V. S. Vavilov) discusses theoretical representations of the main two types of action of radiation on semiconductors: changes in the atomic structure of crystals and ionization, i.e., generation of unbalanced charge carriers. The second part (written by N. A. Ukhin) analyzes the action of radiation on the main types of semiconductor devices. (GRA)

799 (CONF-720360-, pp 13-26) RADIATION EFFECTS IN SEMICONDUCTORS USED AS INFRARED DETECTOR MATERIALS. Naber, J. A. (Gulf Radiation Technology, San Diego, CA). Aug 1972.

From special meeting on the physics of detectors; Orlando, Florida, USA (15 Mar 1972).

In proceedings of the special meeting on the physics of detectors. (Michigan Univ., Ann Arbor (USA). Infrared Information and Analysis Center).

The introduction and annealing of irradiation produced permanent displacement damage effects in semiconductor materials will alter the output of infrared detectors. The introduction of the damage and its annealing depends on the semiconductor material, irradiating particle, semiconductor impurities, temperature and injection level. A knowledge of both the principles of operation of the infrared detector and the effects of radiation and annealing on the basic properties for operation of the detector, permits one to predict the changes in the detector output as a function of nuclear particle irradiation and annealing. (auth)

800 NOISE AND MICROSCOPIC DEFECTS IN ELECTRON-BOMBARDED JUNCTION FIELD EFFECT TRANSITORS. Krishnan, I. N. Tampa, FL; Univ. of Florida (1975). 213p. University Microfilms Order No. 75-17,832.

Thesis (Ph. D.).

The effects of electron bombardment on the noise in Junction Field Effect Transistors (JFETs) have been studied, using a 3 MeV van de Graaff accelerator as the source of electron radiation. As the noise in a JFET can be characterized by the short circuit noise resistance, R/sub n/, the noise conductance, g/sub n/, and correlation conductance, g/sub cor/, quantitative changes in the values of these parameters, which arise as a result of electron bombardment, have been evaluated. This has been accomplished by using the pre- and post-irradiation noise figure characteristics at 100 and 600 KHz, measured over a wide range of source resistances from 300 OMEGA to 745 K OMEGA. It is shown by a sys-

tematic analysis of the changes in the noise parameters that R/sub n/ is the most sensitive noise parameter to electron bombardment and this is attributed to a large increase of generation-recombination (g-r) noise in irradiated JFETs. The large increase of g-r noise is confirmed by means of the frequency spectra of noise in irradiated JFETs, which exhibit well defined time constants, an important characteristic of g-r noise. In order to understand the details of the microscopic mechanisms that cause the g-r noise in irradiated JFETs, use is made of the fact that these mechanisms are strongly temperature dependent. The frequency spectra of noise in irradiated JFETs have been measured at different temperatures by operating the transistors in a temperature controlled environment. By making use of the published values of the microscopic defect associated physical parameters, it has been shown that the theoretical and experimental values of g-r noise could be matched well over the temperature range of 300°K to 90°K and over the frequency range of 100 Hz to 600 KHz. The details of the numerical computations show that the g-r noise due to Shockley-Read-Hall (SRH) centers in the channel is dominant over that in the depletion region, for electron bombarded JFETs, in the frequency range of measurements. (Diss. Abstr. Int., B)

801 PHOTOMULTIPLIER WINDOW MATERIALS UNDER ELECTRON IRRADIATION: FLUORESCENCE AND PHOSPHORESCENCE. Viehmann, W.; Eubanks, A.G.; Pieper, G.F.; Bredekamp, J.H. (NASA Goddard Space Flight Center, Greenbelt, Maryland 20771). Appl. Opt. 14: No. 9, 2104-2115 (Sept 1975).

The fluorescence and phosphorescence of photomultiplier window materials under electron irradiation have been investigated using a Sr^{90}-Y^{90} beta emitter as the electron source. Spectral emission curves of uv-grade, optical-grade, and electron-irradiated samples of MgF_2 and LiF, and of CaF_2, BaF_2, sapphire, fused silica, and uv-transmitting glasses were obtained over the 200–650-nm spectral range. Fluorescence yields, expressed as the number of counts in a solid angle of 2π sr/MeV of incident electron energy deposited [MeV^{-1} $(2\pi\ sr)^{-1}$], were determined on these materials utilizing photomultiplier tubes with cesium telluride, bialkali, and trialkali (S-20) photocathodes, respectively. Typical yields observed with a uv/visible sensitive bialkali cathode range from 10 MeV^{-1} $(2\pi\ sr)^{-1}$ for uv-grade MgF_2 to $\simeq$200 MeV^{-1} $(2\pi\ sr)^{-1}$ for CaF_2. For comparison, sodium-activated cesium iodide, one of the most efficient scintillator materials, yields about 700 MeV^{-1} $(2\pi\ sr)^{-1}$. High-purity fused silica has the lowest yield, approximately 6 MeV^{-1} $(2\pi\ sr)^{-1}$. Optical-grade MgF_2 and LiF, as well as electron-irradiated uv-grade samples of these two materials, show enhanced fluorescence due to color-center formation and associated emission bands in the blue and red wavelength regions. Large variations in fluorescence intensities were found in uv-grade sapphire samples of different origins, particularly in the red end of the spectrum, presumably due to various amounts of chromium-ion content. Phosphorescence decay with time is best described by a sum of exponential terms, with time constants ranging from a few minutes to several days. Phosphorescence intensity expressed as a fraction of the steady-state fluorescence intensity is an extremely sensitive measure of crystalline perfection and purity. This fraction ranges from a high of $\simeq 10^{-2}$ for some fluoride samples to a low of $\leqslant 2 \times 10^{-6}$ for fused silica. Application of the parameters obtained in this work to the analysis of recent flight observations on low light-level experiments yields good quantitative agreement with flight data from OAO-3, OSO-7, and Apollo 17. (auth)

802 NEUTRON DETECTOR WITH GAMMA COMPENSATED CABLE. Warren, H. D. (to Babcock and Wilcox Co.). US Patent 3,892,969. 1 Jul 1975. Filed date 5 Apr 1974. 8p.

An illustrative embodiment of the invention describes a technique for essentially eliminating the radiation induced background currents that are generated in the cable that connects an "in-core" neutron detector to an electrical terminal that is outside of the reactor's radiation field. This undesirable radiation-induced cable current is suppressed through an appropriate selection of conductor and cable sheath materials and sizes that generally satisfy the equation: Z/sub l/sup n/d/sub l/ equals Z/sub s/sup m/d/sub s/ where Z is the atomic number of the material; d is a characteristic of the size of the cable component; m and/n have values between 1 and 5 to express the electron emissivity of the cable component from photoelectric and Compton effects; l represents the conductor; and s represents the sheath. Thus, the radiation-generated electrons emitted from the conductor and the oppositely-directed electrons emitted from the inner surface of the cable sheath are mutually cancelled if this equation is satisfied. A typical cable that does meet this criterion at low temperatures has a centrally disposed Zircaloy-2 inner conductor of 0.011 inch diameter, an annular insulation of magnesium oxide powder compacted to 100 percent density, and an Inconel sheath with an outside diameter of 0.062 inch and 0.011 inch wall thickness. (auth)

803 PRE-IRRADIATION INDICATOR FOR TOTAL-DOSE IONIZING RADIATION-SENSITIVITY. Hughes, H. L. (Naval Research Lab., Washington, DC). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2118-2119(Oct 1975).

A technique providing the means to predict the ionizing radiation-sensitivity of devices possessing insulator-semiconductor structures without requiring irradiation is described. This technique is highly amenable to commercial on-line procedures for controlling processes and hardness-assurance lot-sampling, as well as for process-related hardening investigations. (WHK)

804 RADIATION TESTING OF AN 8-BIT CMOS MICRO-PROCESSOR. King, E. E.; Nelson, G. P. (Naval Research Lab., Washington, DC). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2120(Oct 1975).

An 8-bit CMOS microprocessor has been tested in an ionizing radiation environment. Quiescent current was monitored during the irradiation and clock frequency was a test parameter. Irradiated in a static condition, failure was observed at a total dose of 3×10^4 rads (Si). (auth)

805 RADIATION HARDENING OF MOS DEVICES BY BORON. Danchenko, V. (to United States Government). US Patent 3,882,530. 6 May 1975. Filed date 4 Sep 1973. 6p.

A novel technique is disclosed for radiation hardening of MOS devices and specifically for stabilizing the gate threshold potential at room temperature of a radiation subjected MOS field-effect device of the type having a semiconductor substrate, an insulating layer of oxide on the substrate, and a gate electrode disposed on the insulating layer. In the preferred embodiment, the novel inventive technique contemplates the introduction of boron into the insulating oxide, the boron being introduced within a layer of the oxide of about 100A to 300A thickness immediately adjacent the semiconductor-insulator interface. The concentration of boron in the oxide layer is preferably maintained on the order of 10 atoms/cm^3. The novel technique serves to reduce and substantially annihilate radiation induced positive gate charge accumulations, which accumulations, if not eliminated, would cause shifting of the gate threshold potential of a radiation subjected MOS device, and thus render the device unstable and/or inoperative. (auth)

806 SELECTIVE IRRADIATION FOR FAST SWITCHING THYRISTOR WITH LOW FORWARD VOLTAGE DROP. Brown, J. L. (to Westinghouse Electric Corp.). US Patent 3,877,997. 15 Apr 1975. Filed date 20 Mar 1973. 10p.

The switching speed of a thyristor is increased without correspondingly increasing the forward voltage drop by selectively irradiating at least portions of the PN junction between the conducting and gating portions, and 5 to 30 percent of the adjacent surface area of the conducting portions of the device. 50 to 100 percent of the surface area of the gating portions, and the peripheral portions can also be irradiated at the same time to decrease gate sensitivity and increase blocking voltage of the thyristor, respectively. Preferably, the thyristor is irradiated with electron radiation which preferably is of an intensity greater than 1 MeV and most desirably about 2 MeV. The electron irradiation is preferably to a dosage of between about 1×10^{13} electrons/cm^2 and 1×10^{15} electrons/cm^2. (auth)

807 METHOD FOR IMPROVING THE RADIATION RESISTANCE OF SILICON TRANSISTORS. Bauerlein, R.; Uhl, D. (to Siemens Aktiengesellschaft). US Patent 3,894,890. 15 Jul 1975. Priority date 17 Jul 1972, F. R. Germany. 8p.

A method for improving the radiation resistance of silicon transistors of the type having silicon oxide cover layer is described in which a transistor or a silicon wafer with several transistor structures therein is exposed to electron radiation with an energy below 150 keV for a dose of between 10^9 and 10^{10} rad at the boundary layer between the silicon and the silicon oxide cover layer while being at a temperature of between 200° and 300°C. After the irradiation the transistor or silicon wafer is annealed for at least 10 hours at a temperature of between 200° and 300°C while a voltage of at least 0.3 V is applied in the forward direction between the emitter and the base terminal of the transistor or the transistor structures. (auth)

Miscellaneous Instruments

Refer also to abstracts 1486 and 1845.

808 (CONF-720360-) PROCEEDINGS OF THE SPECIAL MEETING ON THE PHYSICS OF DETECTORS, ORLANDO, FLORIDA, 15 MARCH 1972. (Michigan Univ., Ann Arbor (USA). Infrared Information and Analysis Center). Aug 1972. 143p. Institute of Science and Technology, Univ. of Michigan, Ann Arbor.

From special meeting on the physics of detectors; Orlando, Florida, USA (15 Mar 1972).

Separate abstracts were prepared for 2 of the 13 papers presented. The remaining 11 papers were not within the scope of NSA. (WHC)

For abstracts of individual papers see: 421 and 799.

809 (LMEC-TDR-75-6) HIGH-TEMPERATURE STRAIN GAGE EVALUATION: AILTECH (MICRODOT) MODELS SG-420 AND SG-425. Twa, G. J. (Liquid Metal Engineering Center, Canoga Park, Calif. (USA)). 15 Sep 1975. Contract E(04-3)-700. 334p. AT.

This report describes the development of installation and calibration techniques necessary for use of the Ailtech (Microdot) Series 400 weldable strain gages. This work was performed between late 1968 and mid 1970. Techniques were developed for installation of the strain gage and removal from the calibration bar in the laboratory, which allowed reliable precalibration of the strain gage prior to installation. Evaluation of the Ailtech Models SG-420 and SG-425 strain gages was conducted over the temperature range of room temperature to 900°F. Stabilization techniques were developed to improve the change in gage characteristics with time. Response of these gages under thermal transients was investigated. Sodium proof tests of two SG-425 gages were conducted from October 1974 through March 1975 with no indication of sodium penetration. (auth)

810 (USGS-474-214) NEW PERMANENT-INSTALLATION DEVICE FOR MONITORING STRESS CHANGES IN NX CORE HOLES. Miller, C. H.; Kibler, J. D.; Ege, J. R. (Geological Survey, Denver, Colo. (USA)). Sep. 1975. 60p. Dep. NTIS $5.45.

A solid-inclusion probe has been developed to monitor stress changes in rock. The probe is designed for use in NX-sized drill holes and it can detect stress changes from 0 to 5,000 pounds per square inch from a few milliseconds to a few years in the time domain. These probes have been used to monitor the dynamic stresses of low-yield nuclear detonations at a distance of a few hundred feet and they have remained operable during and after the detonations. The device is composed of fluid-filled hydraulic cells that are mounted radially on a mandrel. The device is emplaced and grouted in a newly drilled NX hole. Stress changes in the wall rock result in borehole diameter changes that vary the hydraulic-cell pressure. Relative cell pressures can be monitored by either Bourdon gages or electronic transducers. Hydraulic-cell pressure changes are used to calculate rock-stress change. (WHK)

811 ULTRAHIGH VACUUM SYSTEM FOR METERING GAS FLOW (LEAKS) AND COMPUTING FLOW RATE (*U*). Fultz, C.R.; Carver, D.W. (Oak Ridge Y-12 Plant, P.O. Box Y, Oak Ridge, Tennessee 37830). J. Vac. Sci. Technol. 12: No. 5, 1088-1091 (Sept 1975).

An instrument is described which is used as a multimass leak detector for quantitative gas-flow-rate (leak-rate) measurements. The system utilizes a residual gas analyser (RGA) (quadrupole-type mass spectrometer) which is calibrated to provide a gas-flow-rate measurement capability in the range of 10^{-9}–10^{-14} mole/s for hydrogen, hydrogen–deuterium, helium, neon, nitrogen, oxygen, argon, and carbon dioxide. An automatic controller for the system is provided by a minicomputer interfaced to the other system components. All arithmetic, logic, and system-control operations are performed by the computer. (auth)

812 NEW METHOD OF LOGARITHMIC PULSE RATE MEASUREMENT. Pilz, R. (Technische Hochschule, Magdeburg, Ger.). Isotopenpraxis; 11: No. 5, 181-185(May 1975). (In German).

After principal considerations, the construction, operating mode and properties of a new system for logarithmic pulse rate measurement are described. Its principle is based on the scanning of one (the lowest) decade by means of a diode circuit providing very accurate logarithmic integration with imaging of higher regions upon the lowest one by means of a frequency divider. The logarithmic error nearly exclusively is determined by the recording instrument and amounts to maximum 0.7% in the given case. The design under consideration renders possible pulse rate measurement covering six or seven decades with logarithmic being less than 1%. (auth)

813 REVERSIBLE DECADE COUNTER USING INTEGRATED CIRCUITS WITH DIGIT INDICATION BY SEVEN-SEGMENT INCANDESCENT DISPLAY. Seidel, L. R.; Ismailov, Kh. A.; Saligov, S. G. (Azerbaidzhan Inst. of Naphtha and Chemistry, Baku). Instrum. Exp. Tech.; 18: No. 1, 109-111 (1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 100-102(1975).

A synchronous reversible decade counter is described, using a 1-2-4-2 self-complementary code with readout by IV-9 incandescent displays. The counter and decoder for the IV-9 are constructed with TTL integrated circuits. (auth)

814 DEVICE FOR MEASURING SEMICONDUCTOR RADIATION SOURCES. Schubert, W.; Wendt, H.; Doss, R. US Patent 3,886,370. 27 May 1975. Filed date 21 Nov 1973. 6p.

In a measuring device, the determination of the local dependence of the intensity and/or the delay time of the recombination radiation on the radiation band of a semiconductor radiation source is reduced to phase measuring so as to enable short delays at 10^{-11} seconds to be determined. The measuring device comprises an excitation source for a semiconductor radiation source, a magnifying optical system which images the semiconductor radiation source on a diaphragm having a radiation receiver in its rear. A phasemeter connected to the excitation receiver on the one hand and to the radiation receiver on the other, compares the phase of the excitation signal to the phase of the received signal. The image of the semiconductor radiation source is displaceable relatively to the diaphragm and can be viewed through an observation system. (auth)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstracts 80, 2263, 2264, and 2516.

815 (AED-CONF-73-434-005) DEVELOPMENT OF A CONTROL STRATEGY FOR THE GLACE BAY HEAVY WATER PLANT. Bradley, K. J.; Lettington, C. J. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.; Canatom Ltd., Montreal, Quebec (Canada)). 1973. 10p. (CONF-731233-2). INIS.

From conference on automatic control; Fredericton, New Brunswick, Canada (24 Sep 1973).

The current generation of heavy water plants exemplify some increasingly common process control problems; particularly that of maintaining operation of extremely large processing units at stable and near optional conditions in a highly interactive environment. The process arrangement used here and the steps being taken to develop a satisfactory control strategy and technique are described. As this plant is operating at the frontier of current process knowledge a comprehensive data gathering and processing system has been specified, and it is intended that some on-line subsystem optimization calculations will be performed, as well as more complete off-site simulation based plant optimization. (auth)

816 (GAT-T-2366) VIBRATION SIGNATURE ANALYSIS OF COMPRESSORS IN THE GASEOUS DIFFUSION PROCESS FOR URANIUM ENRICHMENT. Harbarger, W. B. (Goodyear Atomic Corp., Piketon, Ohio (USA)). 21 Jul 1975. Contract E(33-2)-1. 20p. (CONF-750740-1). Dep. NTIS $4.00.

From engineering foundation conference; Henniker, New Hampshire, USA (28 Jul 1975).

Continuous operation of several thousand axial-flow and centrifugal compressors is vital to the gaseous diffusion process for uranium enrichment. Vibration signature analysis using a minicomputer-based Fast Fourier Transform Analyzer is being applied to the evaluation and surveillance of compressor performance at the Portsmouth Gaseous Diffusion Plant. Three areas of application include: (1) new blade design and prototype compressor evaluation; (2) corrective and preventive maintenance of machinery components; and (3) evaluation of machinery health. The present system is being used to monitor signals from accelerometers mounted on the load-bearing housings of 16 on-line compressors. These signals are transmitted by hard-wire to the analyzer for daily monitoring. A program for expansion of this system to monitor more than a thousand compressors and automation of the signature comparison process is planned for all three gaseous diffusion plants operated for the United States Energy Research and Development Administration. (auth)

817 (GSI-Pk-1-75) ELECTROMAGNETIC NUCLIDE SEPARATOR OF HIGH ACCEPTANCE AND RESOLVING POWER FOR ON-LINE AND OFF-LINE OPERATION AT THE UNILAC. Kornahl, W.; Wagner, H.; Walcher, W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Apr 1975. 71p. (In German). INIS.

An electromagnetic mass separator of high acceptance which is to be used for nuclide separation in heavy ion reactions at the UNILAC is described. The parameters of the heavy ion reactions (e.g., cross sections) are used to assess and calculate the conditions for a separator. The theoretical considerations are followed by a concept for a possible separator. (GE)

818 (ORNL-TM-5089) STABLE ISOTOPE CUSTOMER LIST AND SUMMARY OF SHIPMENTS: FY 1975. Davis, W. C. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 40p. Dep. NTIS $4.00.

This compilation is published as an aid to those concerned with the separation and sale of stable isotopes. The information is divided into four sections: an alphabetical list of domestic and foreign customers, showing the stable isotopes purchased during the fiscal year; an alphabetical list of isotopes, cross-referenced to customer numbers and divided into domestic and foreign categories; an alphabetical list of states and countries, cross-referenced to customer numbers and indicating geographical concentrations of isotope users; and a tabulation of the shipments, quantities, and dollars for domestic, foreign, and project categories for each isotope, with the totals for loaned isotopes shown at the end of the table. (auth)

819 (UCCND-CSD-11) GENERAL PRODUCTIVITY CODE: PRODUCTIVITY OPTIMIZATION OF GASEOUS DIFFUSION CASCADES. The Programmer's Guide. Tunstall, J. N. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Computer Sciences Div.). May 1975. Contract W-7405-eng-26. 257p. Dep. NTIS $7.60.

The General Productivity Code is a FORTRAN IV computer program for the IBM System 360. With its model of the productivity of gaseous diffusion cascades, the program is used to determine optimum cascade performance based on specified operating conditions and to aid in the calculation of optimum operating conditions for a complex of diffusion cascades. This documentation of the program is directed primarily to programmers who will be responsible for updating the code as requested by the users. It is also intended to be an aid in training new Productivity Code users and to serve as a general reference manual. Elements of the mathematical model, the input data requirements, the definitions of the various tasks (Instructions) that can be performed, and a detailed description of most FORTRAN variables and program subroutines are presented. A sample problem is also included. (auth)

820 HIGH-POWER TUNABLE NARROW-BAND ULTRAVIOLET, VISIBLE, AND INFRARED NEODYMIUM-GLASS LASER FOR USE IN SELECTIVE PHOTOCHEMISTRY. Ambartsumyan, R.V.; Apatin, V.M.; Letokhov, V.S.; Mishin, V.I. (Institute of Spectroscopy, Academy of Sciences of the USSR, Akademgorodok, Moscow Province). Sov. J. Quantum Electron. 5: No. 2, 191-194 (Aug 1975).

A neodymium-glass laser, continuously tunable in the 200 Å range and with a relative frequency stability of 2×10^{-6}, was developed. Selective photopredissociation of a mixture of H_2CO and D_2CO by the third harmonic resulted in a deuterium enrichment in the ratio 1:9. (auth)

Isotopic Power Sources

821 (BNWL-1845-12) PACIFIC NORTHWEST LABORATORY QUARTERLY REPORT TO ADVANCED NUCLEAR ENERGY SYSTEMS, SPACE AND SPECIAL PURPOSES DIVISION, APRIL-JUNE 1975. Fullam, H. T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1975. Contract E(45-1)-1830. 21p. Dep. NTIS $4.00.

At Hanford, strontium will be separated from the high-level waste, converted to the fluoride, and doubly encapsulated in small, high-integrity containers for subsequent long-term storage. The fluoride conversion, encapsulation and storage will take place in the Waste Encapsulation and Storage Facilities (WESF). The encapsulated strontium fluoride represents an economical source of ^{90}Sr if the WESF capsule can be licensed for heat source applications under anticipated use conditions. The objectives of this program are to obtain the data needed to license $^{90}SrF_2$ heat sources and specifically the WESF $^{90}SrF_2$ capsules. The information needed for licensing can be divided into three general areas: long-term SrF_2 compatibility data; chemical and physical property data on $^{90}SrF_2$; and capsule property data such as external corrosion resistance, crush strength, etc. The current program is designed to provide the required information. (auth)

822 (BNWL--1845-13) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT TO ADVANCED NUCLEAR ENERGY SYSTEMS, SPACE AND SPECIAL PURPOSES DIVISION FOR JULY 1975. Fullam, H. T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1975. Contract E(45-1)-1830. 8p. Dep. NTIS $4.00.

At Hanford, strontium will be separated from the high-level waste, then converted to the fluoride, and doubly encapsulated in small, high-integrity containers for subsequent long-term storage. The fluoride conversion, encapsulation and storage will take place in the Waste Encapsulation and Storage Facilities (WESF). This encapsulated strontium fluoride represents an economical source of ^{90}Sr if the WESF capsule can be licensed for heat source applications under anticipated use conditions. The objectives of this program are to obtain the data needed to license $^{90}SrF_2$ heat sources and specifically the WESF $^{90}SrF_2$ capsules. The information needed for licensing can be divided into three general areas: long-term SrF_2 compatibility data; chemical and physical property data on $^{90}SrF_2$; and capsule property data such as external corrosion resistance, crush strength, etc. The current program is designed to provide the required information. (auth)

823 (SC-RR-66-272) ANALYSIS OF THE NEED FOR AGENA COMMAND DESTRUCT AND/OR GENERATOR EJECT SYSTEMS ON THE NIMBUS B/SNAP-19 MISSION. (Sandia Labs., Albuquerque, N. Mex. (USA)). May 1966. 69p. Dep. NTIS $5.50.

Declassified 20 Oct 1975.

This report evaluates from a safety viewpoint the need for Agena command destruct and/or command or thermal generator eject systems on the Nimbus B/SNAP-19 mission. The following conclusions and recommendations were reached: The need for the Agena command destruct capability appears marginal. However, it is understood that the Agena burn can be terminated by use of the sequence timer if shroud separation is not accomplished. Since this capability can be provided at a small fraction of the cost of the Agena command destruct capability and since this capability seems desirable, its incorporation is recommended. Neither the command nor thermal eject systems for separating the SNAP-19 from the Nimbus B was found to significantly enhance system safety. On the basis of the information contained in these studies, a generator eject system does not appear to be required. For orbital reentry, after Nimbus B separation from Agena, the probability of fuel release in the desired area above the fuel melt zone is increased if the Nimbus B is tumbling. Therefore, it is desirable that the solar paddles be unfolded prior to orbital reentry. (It is understood that solar paddle deployment is accomplished automatically by a timer which is initiated by separation of the Nimbus B from the Agena.) (TFD)

824 (TID--26868) PROGRAM OF THERMOELECTRIC GENERATOR TESTING AND RTG DEGRADATION MECHANISMS EVALUATION. Progress Report No. 11. (Jet Propulsion Lab., Pasadena, Calif. (USA)). May 1975. Contract AT(04-3)-959. 86p. Dep. NTIS $7.50.

Research progress for March-April 1975 is reported on the development of a radioisotope-fueled thermoelectric generator. The report is divided into two parts. Part I–Silicon Germanium Technology contains sections on experiments with silicon nitride-coated hot shoes, resistance and thermal conductivity of multifoil insulation, material compatibility experiments, TBC-1 generator performance analysis, and thermoelectric property characteristics. Part II–Thermoelectric Generator Test and Evaluation contains sections on high performance generator HPG SN-2, transit generator QM-III, ring converter, MHW-TBC-1, and RCA reference generator. (TD)

825 LOW-TEMPERATURE HEAT-PULSE CALORIMETRY FOR SELF-HEATING RADIOACTIVE SAMPLES. Trainor, R.J.; Knapp, G.S.; Brodsky, M.B.; Pokorny, G.J.; Snyder, R.B. (Argonne National Laboratory, Argonne, Illinois 60439). Rev. Sci. Instrum. 46: No. 10, 1368-1373 (Oct 1975).

A heat-pulse technique is described for measuring low-temperature heat capacities of radioactive self-heating samples in the range 2–60 K. The method also provides a simple alternative to traditional heat-pulse methods for measuring nonradioactive samples and is attractive because a heat switch is not required. Data for copper indicate an overall accuracy of about 1%. Heat capacity data for plutonium-242 between 4 and 13 K are also presented. (auth)

826 PROTECTED ISOTOPE HEAT SOURCE. Burns, R. K.; Shure, L. I.; Katzen, E. D. (to National Aeronautics and Space Administration). US Patent 3,899,680. 12 Aug.1975. Filed date 26 May 1971. 4p.

A radioactive isotope capsule is disposed in a container (heat shield) which will have a single stable trim attitude when reentering the earth's atmosphere and while falling to earth. The center of gravity of the heat source is located forward of the midpoint between the front face and the rear face of the container. The capsule is insulated from the front face of the container but not from the rear surface of the container. (auth)

Radiation Sources

Refer also to abstracts 746 and 814.

827 (IKE-6-73D) STUDIES ON THE OPTIMAL COLLIMATION OF FAST NEUTRONS FOR NEUTRON THERAPY. Pfister, G. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Aug 1973. 127p. (In German). INIS.

Thesis.

Optimal dimensions and materials of collimators for the neutron therapy installations under construction in Hamburg and Heidelberg were investigated by computer simulation of clinical irradiations. The neutron transport from the source through collimator and phantom was calculated by numerical solution of the Boltzmann equation by the S_n method with first collision correction. It was shown that the collimater quantity can be the same for both installations if the same materials are used. With homogeneous distribution of the materials in the collimator, tungsten was found to be most suitable, but almost the same results were achieved with nickel. Alloys of various elements did not improve W/Fe and Fe/(CH_2 distribution significantly improved the collimator quantity. The radiation scattering component is reduced by filters, by smaller beam cross sections, and by longer collimators. The γ quanta which are due to nuclear excitation and by the isotopes produced in the collimator are not dangerous to the patient. Long-term activation of the collimator material should, however, be allowed for in order to ensure radiation protection of the operating personnel. A hardening of the neutron energy spectra on the sides of the useful radiation beam could be determined. (auth)

828 (INIS-mf-1416) RADIOACTIVE ISOTOPES AND RADIATION PROTECTION AS APPLIED IN THE FOUNDRY. Basson, J. K. (South African Inst. of Foundrymen, Johannesburg; South African Association for Non-destructive Testing, Pretoria). 1972. 20p. (CONF-720748–2). INIS.

From symposium on physical processes responsible for dispersal of pollutants in the sea; Aarhus, Denmark (4 Jul 1972).

As South African industry becomes more sophisticated it must also take increasing cognizance of the possibilities of nuclear techniques. The application of radioisotopes and radiation in foundry technology depends on their physical properties. The metal industry has progressed satisfactorily in the application of radioactive isotopes and radiation by well-established techniques such as gauging and gamma radiography. Fuller exploitation of radioactive tracer techniques in foundry-making as well as the possibilities of neutron radiography is discussed. The radioactive decay of the atomic nucleus is explained as well as the absorption of gamma rays. The maximum permissible doses laid down by the Atomic Energy Board as recommended by the ICRP are summarized. (INIS)

829 (JU-RR-75/4) HELIUM-JET TRANSPORT TECHNIQUE APPLIED TO A ^{252}Cf SOURCE AT THE TEMPERATURE OF LIQUID AIR. Hellmuth, K. H.; Hillebrand, S.; Suominen, P.; Valli, K.; Aeystoe, J. (Jyvaeskylae Univ. (Finland). Dept. of Physics). Apr 1975. 14p. Dep. NTIS (US Sales Only) $4.00.

The construction and main characteristics of a special ^{252}Cf source is described. Fission products can be transported from the source in a stream of pure helium over distances of several meters within time intervals of less than 100 ms. A typical transport time is 1 s. The source and the transport line are cooled to the temperature of liquid air. The method is superior in a variety of applications where carrier substances such as aerosol particles cannot be tolerated. Fission fragments have been transported onto metal foils for direct radiation analysis, into liquids for rapid radiochemical separation, and into the ion source of a mass separator. Biological and medical applications are anticipated. The transport efficiency is typically 40 to 70 per cent. The source was 2 μg of ^{252}Cf; stronger sources can be used. (auth)

830 ERRORS IN MEASURING THE DISTRIBUTION OF A SUBSTANCE OVER THE DEPTH OF A THICK ALPHA SOURCE BY A SPECTROMETRIC METHOD. Kononovich, A. L.; Klochkov, V. N. (Inst. of Biophysics, Moscow). Instrum. Exp. Tech.; 18: No. 1, 32-35(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 37-40(1975).

A method is described for measuring the distribution of an α active substance over the depth of a thick source, based on recording of the energy spectrum of the α particles. An analysis is given of the principal sources of error affecting the result, and their contribution to the total measurement error is calculated. (auth)

831 STANDARD LIGHT SOURCE UTILIZING SPONTANEOUS RADIATION. Yamamoto, O.; Takenaga, M.; Tsujimoto, Y. (to Matsushita Electric Industrial Co., Ltd.). US Patent 3,889,124. 10 Jun 1975. Priority date 26 Jun 1972, Japan. 6p.

A standard light source is described utilizing spontaneous radiation made by mixing a fluorescent substance $LnVO_4$: X (wherein Ln is Y or Gd, and X is Dy or Eu) with a radioactive substance containing a radioactive isotope which is less in the degree of temperature variation of the intensity of emitted light and excellent in stability. Particularly when used in a light-receiving device having photomultiplier tubes, the said light source emits light quite similar to that of a thermoluminescent substance such as $CaSO_4$: X (wherein X is Im, Dy, Sm or Mn), LiF or Mg_2SiO_4 : Tb, and is excellent as a calibration high-stability standard light source for use in the above-mentioned light-receiving device. (auth)

Design and Fabrication

Refer also to abstract 791.

832 IRRADIATION DEVICE. Bosshard, E. (to Sulzer Bros. Ltd., Winterthur (Switzerland)). Swiss Patent Document 536544/D/. 15 Jun 1973. 4p. (In German).

An irradiation chamber installation is described in which the irradiated products pass before a γ source. The installation, at both the inlet and outlet, consists of a vertical wall forming a shield, around which the products to be irradiated follow a

labyrinthine path on both sides. The labyrinthine circuit is arranged so that the products follow a path which, in projection on a vertical plane perpendicular to that of the shield, is parallel to the shield on the side opposite the irradiation chamber and to the chamber side. The circuit passes above the shield connecting these two parallel sections. (tr-INIS)

833 IRRADIATION UNIT FOR THERAPY BY RAYS OF SECOND OR HIGHER ORDER. Barataud, Claude. (to Barapio S. A., Collonge-Bellerive (Switzerland)). Swiss Patent Document 537196/D/. 13 Jun 1973. 2p. (In French).

A therapeutic irradiation device is described. The protective coating has a sealed external container. Inside the container is a shield consisting of a light material surrounding the γ source and the first solid filter. (tr-INIS)

834 PULSE-TYPE NEUTRON X-RAY TUBE. Bessarabskii, Yu. G.; Demidov, F. P.; Ovsyannikov, S. B. Instrum. Exp. Tech.; 18: No. 1, 246-247(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 211-213(1975).

A pulse-type neutron x-ray tube generating neutrons and x radiation at the same time is described. The working voltage of the tube is up to 200 kV. The adjusting and service characteristics of the tube are presented. The tube allows easy control of the parameters characterizing the radiation generated. (auth)

Industrial Uses

Refer also to abstract 86.

835 (KFK-2182) WEAR MEASUREMENTS BY MEANS OF RADIONUCLIDES. Herkert, B. (Kernforschungszentrum Karlsruhe (F. R. Germany). Lab. fuer Isotopentechnik). Jul 1975. 37p. (In German). Dep. NTIS (US Sales Only) $5.00.

Oil transport of wear particles is the most frequently used method of wear measurement by means of radionuclides. The measuring method, calibration, and all essential factors governing wear measurements are treated. It is shown how the activity of the machine parts can be computed, the wear of which is to be measured. The γ-spectra of the involved radionuclides and all relevant measuring conditions are taken into account. (auth)

836 (NP-20570) RADIOGRAPHIC ANALYSIS OF INTERNAL INFESTATION OF STORED CORN. Flores y Bermudez, R. (Universidad Nacional Autonama de Mexico, Mexico City. Facultad de Ciencias). 1975. 172p. (In Spanish). Dep. NTIS (US Sales Only) $11.75.

Thesis.

The principles of the interaction of radiation with matter and the characteristics of x-ray generators are reviewed. A revision is then made of the concepts of dosimetry. The principles of x-ray radiography are analyzed. The possibilities offered by x-ray radiography for the observation of the internal infestation of grains are discussed. The results of experimental studies on the observation of cavities or holes in grains infested with insects are reported. The conditions necessary for reproducibility of x-radiographic studies are determined. The x-ray generator used is described. (JSR)

837 RADIOAUTOGRAPHICAL INVESTIGATIONS IN MIXING PROCESSES OF BUILDING MATERIAL COMPONENTS. Wagner, K.; Lucke, H.; Brutschin, F. (Zentralinstitut fuer Physikalische, Berlin). Isotopenpraxis; 11: No. 4, 144-149(Apr 1975). (In German).

The fine mixing of lime-sand-mixes is a necessary requirement for high strength of silicate building materials. Comparative investigations in the distribution of lime in neutron-activated samples of fine grain building materials by scintillation counting of ^{47}Ca and radioautographic reproduction of the distribution of ^{45}Ca in small samples were performed. The radioautograph results on homogeneity show the best correspondence with the compressive strength of the samples. (auth)

838 RADIOACTIVE TRACER APPLICATIONS IN THE STUDY OF FLOW REACTORS. IV. The Dynamic Characteristic of Gas in a Fluidized Bed of Granular Material in a Rotary-Jet Pilot Reactor. Thyn, J.; Hovorka, J. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague). Radioisotopy; 16: No. 3, 335-358(Jul 1975). (In Czech)

The response curves of gas streaming through jet fluidized beds of granular material in a pilot reactor with a rotary jet were measured for a number of gas flow rates and a mathematical model of the gas residence time distribution was designed. The good agreement of the mathematical model with the experiments permits the determination of the ratio of the streaming through the fluidized bed in the form of bubbles of different size. The measured values were evaluated as: (1) the density of the gas residence time (age) distribution on the outflow; (2) the distribution function of the internal gas age in the device; and (3) the so-called intensity function. The gas was labelled by rapid injection of the radioactive radionuclide krypton-85 and the response was detected with specially connected Geiger-Mueller tubes which were situated directly in the device, immediately above the bed of granular material. (auth)

839 RADIATION TREATMENT METHOD AND APPARATUS FOR DECONTAMINATION OF POLLUTED FLUID. Lund, N.; Bialy, K. J.; Mann, L. A.; Woodbridge, D. D. (to Energy Systems, Inc.). US Patent 3,904,882. 9 Sep 1975. Filed date 11 May 1970. 6p.

A radiation treatment method and apparatus for the safe disinfection and decontamination of liquid waste, such as sewage are described. Liquid waste is processed by removing some solids from the effluent, irradiating the effluent less some solids, with a gamma radiation field and percolating the disinfected effluent, or discharging the disinfected liquid into sewate conduits or into other bodies of water. The disinfecting chamber is a box constructed of concrete or other compatible material, having a radiation shielding cover, and having an inlet at one end and an exit at the other end. Baffles located in the box produce desired distribution and turbulence of flow. Sources of ionizing radiation, usually gamma radiation, are placed in the chamber in such a manner as to provide a relatively uniform radiation field in the effluent passing through the system. (auth)

LIFE SCIENCES

Refer also to abstracts 870 and 880.

840 (AED-CONF-75-061-021) OZONE VS. IRRADIATION TREATMENT OF ORGANIC IMPURITIES IN WATER. Hoigne, J. (Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Duebendorf (Switzerland)). 1975. 9p. (SM-194/410). INIS.

From symposium on the use of high level radiation in waste treatment: status and prospects; Munich, F. R. Germany (17 Mar 1975).

Depending on the reaction conditions, radiation and ozone yield the same reactive intermediates in aqueous oxygenated solutions. In both systems the OH^- radical can become the main species for the oxidation of organic impurities. The oxidizing intermediate produced by ozone was identified by comparing its reaction-selectivity with those known for the OH^- radicals initiated by high-energy irradiation. The conditions were investigated (pH-range and solutes) for which the predecomposition of ozone to OH^- radicals becomes effective before ozone reacts directly with dissolved solutes. (GE)

Radiation Effects on Biochemicals

841 (AECL-5178, pp 49-61) BIOLOGY BRANCH. Baldwin, W. F. May 1975.

In Biology and Health Physics Branch. Progress Report, 1 January-31 March 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Research on biochemistry and molecular biology included studies on polypyrimidines in DNA from eukaryotes; radioinduced tumors in rats; radiosensitivity of Micrococcus radiodurans to ^{125}I; ionizing radiation damage to cell walls; repair of DNA strand breaks; and endonucleolytic activity in chick embryo extracts active on gamma-irradiated DNA. Research on genetics, development, and population included radiosensitivity of bacteriophage T4; polyacrylamide gel electrophoresis of intact bacteriophage T4 particles; radiation genetics in insects; and effects of radiation on biting flies. (HLW)

842 UTILIZATION OF THE PARAMAGNETIC LABEL METHOD FOR STUDYING CONFORMATIONAL CHANGES IN DNA FOLLOWING UV IRRADIATION. Mil', E. M.; Zhil'tsova, V. M.; Kruglyakova, K. E. (AN SSSR, Moscow. Inst. Khimicheskoj Fiziki). Biofizika; 19: No. 4, 601-604(May 1974). (In Russian).

For English translation see the journal Biophysics.

A study is made of the kinetics of conformational changes in locally denatured sections of the DNA molecule occurring as a result of ultraviolet irradiation. It is shown that a change in the parameter J_o is a good indicator of the general process of DNA degradation, while a change in the parameter τ_o is a good indicator of conformational rearrangements in locally denatured sections of the macromolecule. The character of the dependence of τ_o on dose for three concentrations is apparently caused by the different degree of aggregation of the macromolecules. (tr-auth)

843 POSTREPLICATIVE REPARATION OF DNA IN CELLS OF UV-SENSITIVE STRAINS OF ESCHERICHIA COLI B. Svetlova, M. P.; Tomilin, N. V.; Zhestyannikov, V. D. (AN SSSR, Leningrad. Inst. Tsitologii). Genetika; 216: No. 2, 430-433 (May 1974). (In Russian).

For English translation see the journal Sov. Genet.

A study was made of a factor determining the resistance of E. coli cell strains B_{s-1} γR to ultraviolet irradiation. The data indicate that the recovery of post-replicated DNA samples in uv-irradiated cells is closely associated with their uv-resistance. It is proposed that regulation of postreplicative recovery is associated with some subcellular structure localized in the cell envelope whose components are products of the genes rec A and 1 on. (INIS)

844 NEAR-ULTRAVIOLET LIGHT-INDUCED STRAND BREAKS IN DNA PRETREATED WITH THE CARCINOGEN, N-ACETOXY-2-ACETYLAMINOFLUORENE. Deering, R. A.; Taylor, W. D.; Burns, L. R. (Pennsylvania State Univ., University Park). Biophys. J.; 15: No. 3, 181-190(Mar 1975).

Neutral sucrose gradients of supercoiled DNA (PHI X-174 RF1) were used to measure the in vitro production of strand breaks by the carcinogen, N-acetoxy-2-acetylaminofluorene (AcO-AAF). Treatment with AcO-AAF in 10 percent dimethyl sulfoxide did not directly yield strand breaks. Breaks in relatively low yield appeared after alkali treatment (pH 13, 60 min) of the RF I previously reacted with AcO-AAF. The DNA treated with AcO-AAF was sensitive to single-strand breakage by 303 nm near-ultraviolet light under neutral conditions. The greater the prior AcO-AAF treatment, the greater the sensitivity to 303 nm light. Post-irradiation alkali treatment greatly enhanced the light-induced strand breakage. (auth)

845 LOCATING INTERRUPTED HYDROGEN BONDING IN THE SECONDARY STRUCTURE OF PM2 CIRCULAR DNA BY COMPARATIVE DENATURATION MAPPING. Jacob, R. J.; Lebowitz, J.; Kleinschmidt, A. K. (Syracuse Univ., NY). J. Virol.; 13: No. 6, 1176-1185(Jun 1974).

Previous studies with HCHO have revealed a reaction with superhelical DNA that strongly suggests that this DNA consists of small regions of interrupted secondary structure. To map these sites in PM2 DNA, the following set of experiments was performed using electron microscopy. A denaturation map of nicked form II was obtained using Inman's alkaline-HCHO conditions. The superhelical form I was reacted with HCHO at 30 C until equilibrium was achieved at the interrupted sites (3.6 percent reactivity). The excess HCHO was removed rapidly and x-ray treatment was employed to nick these prereacted molecules. These form II molecules containing HCHO (form II HCHO) were also subjected to denaturation mapping. It would be expected that the HCHO-unpaired regions would serve as induction sites for the propagation of melting. Hence, depending on the location of the induction sites, we would anticipate either the creation of new regions of melting or a normal denaturation map shifted to lower pH values. Comparison of the development of progressive denaturation of form II and form II HCHO reveals that the latter is the case. The denaturation maps of form II are highly organized patterns of adenine-thymine (AT)-rich regions, with a total of five regions at extreme pH conditions. There are six highly organized regions for form II HCHO, i.e., smaller adjacent loops, at low denaturation conditions where no denaturation is seen for form II. These coalesce into the pattern for form II containing four of five A-T-rich regions observed for form II. Hence we conclude that the regions of altered hydrogen bonding in superhelical PM2 DNA are four to six in number and they map in the A-T-rich regions of the DNA. (auth)

846 DETOXICATION OF ENTERIC BACTERIA ENDOTOXIN BY GAMMA IRRADIATION. Tumanyan, M. A.; Duplishcheva, A. P.; Sinilova, N. G.; Ivanov, K. K. (Inst. of Epidemiology and Microbiology, Moscow). Zh. Mikrobiol., Epidemiol. Immunobiol.; No. 3, 147(1975). (In Russian).

Somatic O antigens and lipopolysaccharides isolated from S. typhi 2 4446, S. paratyphi B-42, Pr. vulgaris 1, Pr. mirabilis 4, proteus strain OX_{19}221, E. coli K-12 and 5396/38, and Sh. dysenteriae flexneri 516 and 550 were subjected to gamma radiation to reduce or eliminate their toxicity. Exposure to 3 mrad was found to decrease the toxicity two- to four-fold in comparison with the native preparation. The decrease in toxicity was apparently due to alterations in the lipid fraction; gel filtration studies and determinations of IR spectra indicated marked physicochemical changes had occurred. (JPRS)

847 ABOUT THE MANIFESTATION OF THE PRIMARY STRUCTURE DEFECTS OF X-IRRADIATED DNA IN KINETIC EXPERIMENTS. Fonarev, A. B.; Shugalii, A. V.; Todorov, I. N.; Shantir, V. I.; Paskevich, I. F. (Medical Radiology Inst., Kharkov). Stud. Biophys.; 51: No. 1, 15-22(1975).

The defect distribution character of primary and secondary structure of DNA, when extracted from x-irradiated 0.025% solutions of calf thymus DNA, is studied as well as the influence of these defects on the reassociation kinetics. The character of the defect region distribution along the macromolecule chain is discussed. The reassociation kinetics of irradiated DNA-preparations is shown to possess a complicated character differing from the native preparation kinetics. After the 5kR dose, the defect region distribution on unique and repeated sequences is shown to be close to the equiprobable one. (auth)

848 THERMOLUMINESCENT PROPERTIES OF CRYSTALLINE HALOGEN SUBSTITUTED URACILS. Crittenden, G. C.; Haugen, O.; Prydz, S. (Univ. of Oslo). Int. J. Radiat. Biol.; 27: No. 5, 447-454(May 1975).

The thermoluminescent properties of crystalline uracil (U), and its halogen-substituted derivatives, 5 bromo-uracil (5BrU), 5 fluorouracil (5FU) and 5 iodo-uracil (5IU), have been investigated. The x-ray-induced thermoluminescent output increases in the order U < 5FU < 5BrU < 5IU. However, a reversed relationship is found for the U. V.-stimulated thermoluminescence. The thermoluminescence-emission spectra suggest that the same

de-excitation process operates in all the halogen-substituted uracils, but the glow curves show that the charge-trapping characteristics are different for each material. (auth)

849 EFFECTS OF X RAYS ON AG-DNA COMPLEXES. Goff, H.; Powers, E. L. (Univ. of Texas, Austin). Int. J. Radiat. Biol.; 27: No. 5, 503-507(May 1975).

Effects of 300 kVp x radiation on silver(I)-complexed calf thymus DNA in neutral aqueous solution were determined by spectrophotometric and sedimentation methods. Complexed silver ion in the ratio of one Ag^+: two DNA bases does not increase the radiosensitivity of DNA. Experiments with added N_2O and alcohols implicate the hydroxyl radical as the most important damaging species in both native DNA and Ag^+-bound DNA. (auth)

850 COMPARISON OF THE OXYGEN-ENHANCEMENT RATIO FOR γ-RAY-INDUCED DOUBLE-STRAND BREAKS IN THE DNA OF BACTERIOPHAGE T7 AS DETERMINED BY TWO DIFFERENT METHODS OF ANALYSIS. van der Schans, G. P.; van der Drift, A. C. M. (Rijksverdediginogsorganisatie TNO, Rijswijk, Netherlands). Int. J. Radiat. Biol.; 27: No. 5, 437-446(May 1975).

Bacteriophage T7 was irradiated in a protecting medium under nitrogen and oxygen with ^{60}Co gamma rays. Double-strand breaks were measured by subrose-gradient sedimentation and by boundary-sedimentation analysis. Both methods showed that the presence of oxygen during irradiation enhanced the production of double-strand breaks. This is at variance with a recent report which suggests that boundary-sedimentation analysis does not show an effect of oxygen. The discrepancy must be ascribed to differences in interpretation of the sedimentation data. (auth)

851 HEAT DENATURATION OF LACTATE DEHYDROGENASE FOLLOWING X-RAY TREATMENT. Werner, A. E. Erlangen, Ger.; Erlangen-Nuernberg Univ. (1973). 57p. (In German). INIS.

Thesis.

A 1% LDH crystal suspension in 2.2 M ammonium sulfate was irradiated with 60 kV X-radiation. The LDH activity determined by an optical method exhibited an exponential dose dependence. The half-value dose was 2.15 Mrd. The non-irradiated LDH as well as the LDH irradiated with a dose of 4.5 Mrd, after dissolving in M/15 phosphate buffer pH 6.3 at a concentration of 32 μg enzyme protein per ml at temperatures between 46°C and 68°C was thermally inactivated and the time decrease of the enzyme activity was measured. It was shown that the starting thermal inactivation of the native LDH can be satisfactorily described by a first order reaction. By means of the Arrhenius equation, the activation energy was found to be 520 kJ/Mol. Contrary to this, the time slope of the rest activity of about 25% after a dose of 4.5 Mrd cannot be described by a first order reaction, but by a sum of exponential functions. This sum probably corresponds to the chromatographically detectable spectrum of molecule fraction of the LDH after irradiation. The single subfractions correspond to the parts of the sum of the exponential functions for the description of the time slope of the thermal inactivation. From the temperature dependence of an average rate constant, an average activation energy of 150 kJ/Mol was determined. The activation energy is only half as large as that of the native LDH. This is to be considered as expression of considerable changes due to radiation in the native structure of LDH with still available enzymatic activity. These structural changes may be considered as a kind of predenaturation as from then on, a considerably smaller activation energy is required for the thermal denaturation. (GE)

852 INFLUENCE OF OXYGEN ON THE RADIOREACTION IN DNA. Frey, R. Karlsruhe, Ger.; Univ. Karlsruhe (1973). 42p. (In German). INIS.

Thesis.

The sensitization due to oxygen in the irradiation of DNA in aqueous solution was investigated. The following parameters were examined: change of the secondary structure, double and single strand break rates, nature of the broken ends, inhibition of the DNA polymerase through irradiated DNA, matrix function of irradiated DNA in the RNA synthesis and infectivity of irradiated T1-DNA. Under accurately determined gaseous conditions, it was found that the single strand break rates increase by a factor of 2.4 in the presence of O_2. The number of final monophosphates show an oxygen effect of 2.0. The number of the 5'-OH- and the 5'-P end groups prior to alkali treatment is not noticeably affected by the oxygen during irradiation. The double strand break rate also exhibits an oxygen effect. However, it is not as high as could be expected from the single strand break rate. It was concluded from the analysis of the dose-effect curve for the double strand break rate and the analysis of the broken ends that the share of alkali labile breaks in the DNA irradiated in the presence of oxygen is increased. When irradiating in the presence of O_2, a greater change in the secondary structure of the DNA occurs than when irradiating in the absence of O_2. This fact cannot be ascribed to strand breaks alone. The increased lesions occuring in the presence of O_2 also inhibit the DNA polymerase but are of no significance as a stop point for the RNA polymerase. It could be shown with infectious T1-DNA that the host cell, besides many other lesions, can also eliminate all damage occurring with increased frequency by irradiation in the presence of O_2. The lethal phenomenon has a G-value of about 0.05 and exhibits no oxygen effect. (GE)

Radiation Effects on Cells

Refer also to abstract 901.

853 (LA-6049-MS) SURVIVAL OF CULTURED MAMMALIAN CELLS IRRADIATED AT VARIOUS DEPTHS IN THE LAMPF NEGATIVE PION THERAPY BEAM. Todd, P. W.; Dicello, J.; West, G.; Shonk, C.; Kligerman, M. M.; Raju, M. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1975. Contract W-7405-Eng-36. 4p. Dep. NTIS $4.00.

Cultured human kidney T-1 cells were irradiated in flasks or on coverslips at different depths in a water phantom using the Clinton P. Anderson Meson Physics Facility (LAMPF) negative pion beam. Studies of cell survival and division delay as a function of depth and recovery between doses indicate RBEs of 1.8 +- 0.3 and an ability of cells to recover between two doses of stopping pions. (auth)

854 (SSI--1974-028) MICRODOSIMETRY AS APPLIED TO THE STUDY OF RADIATION DAMAGE IN DNA. Bengtsson, L. G. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Sep 1974. 22p. (CONF-7409129--1). Dep. NTIS (US Sales Only) $4.25.

From meeting on space biophysics; Uppsala, Sweden (23 Sep 1974).

This paper presents preliminary attempts at relating the microscopic distribution of energy deposited in irradiated objects to biological effects where DNA damage and its repair may be significant. A short review is given of charged particle track structure, and the significance of energy deposition straggling is discussed. It is shown that the relation between microscopic energy deposition and inactivation of bacterial spores, bacteria, and mammalian cells is the same for heavy charged particles and gamma rays, apart from an approximately constant factor by which the heavy charged particles are more efficient in producing inactivation. This factor goes from 1 for bacteria to 13 for bacterial spores with H_2S available, and its value may be of interest for considerations of the combined mechanisms of radiation damage and repair. The energy deposited seemed more suitable for the description than energy per unit mass or length. The microscopic energy distribution may, with some limited assumptions, permit estimates of the likelihood of a linear dose-response relationship at low doses. Microdosimetry is finally used to show that the synchrony between heavy charged particles and gamma rays seems to hold also when threshold effects show up. The threshold effects consistent with published biological data seem to be large for mutations due to chromosome breaks in maize seeds, moderate for the formation of dicentrics in mammalian lymphocytes and small or non-existent for mutations in Tradescantia stamen hairs. Further studies along the lines drawn up in the paper should be indicated. (auth)

855 RESPONSE OF A HUMAN MALIGNANT MELANOMA CELL LINE TO HIGH LET RADIATION. Thomson, L. F.; Smith, A. R.; Humphrey, R. M. (Univ. of Texas, Houston). Radiology; 117: No. 1, 155-158(Oct 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

The response of a human malignant melanoma cell line in vitro to high linear energy transfer radiation was studied utilizing the neutrons produced by the reaction of 16 and 50 MeV deuterons on beryllium. The relative biological effectiveness (RBE) relative to cobalt-60 gamma radiation was determined under conditions of complete oxygenation. The data indicate that the radioresistance ascribed to malignant melanoma in vivo is not an intrinsic quality of the cell but rather may be mediated by the in vivo environment. (auth)

856 RADIOBIOLOGICAL PROPERTIES OF HIGH-ENERGY CYCLOTRON-PRODUCED NEUTRONS USED FOR RADIOTHERAPY. Hall, E. J.; Roizin-Towle, L.; Theus, R. B.; August, L. S. (Columbia Univ., New York). Radiology; 117: No. 1, 173-178 (Oct 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Radiobiological properties of high-energy cyclotron-produced neutrons were investigated. The survival curve for mammalian cells exposed to 35 MeV neutrons has an appreciable shoulder, but exhibits a significant initial slope at low doses. Split-dose experiments, using doses comparable to the daily fractions of neutron therapy, indicate no repair of sublethal damage. The nitroimidazoles, and particularly Flagyl, have been shown to selectively sensitize hypoxic cells to the effects of x rays. Experiments demonstrated that Flagyl is equally effective in reducing the oxygen enhancement ratio for high-energy neutrons. Hypoxic sensitizers must be regarded as an adjunct to neutron therapy, rather than as a competitor. (auth)

857 CELL CYCLE PROGRESSION OF MURINE SARCOMA CELLS AFTER X IRRADIATION OR HEAT SHOCK. Kal, H. B.; Hatfield, M.; Hahn, G. M. (Stanford Univ., California). Radiology; 117: No. 1, 215-217(Oct 1975).

DNA histograms of exponentially growing EMT-6 (cultured mammary sarcoma) cells in vitro were obtained at regular time intervals after exposure to 300 rads of x rays or one hour of heat shock at 43°C. After either treatment, about 70 percent of the cells retained clonogenicity. Irradiation induced the expected block in the G_2 + M phase, resulting in an increase of cells in that phase during the first 5 hours after exposure. Heat shock caused a block in both the S and G_2 + M phases. (auth)

858 HYPERTHERMIA: BIOLOGICAL STUDIES AT THE CELLULAR LEVEL. Harisiadis, L.; Hall, E. J.; Kraljevic, U.; Borek, C. (Columbia Univ., New York). Radiology; 117: No. 2, 447-452(Nov 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Tissue culture techniques were used to study the effect of hyperthermia on several cell types, including normal liver and hepatoma cells, as well as cell lines that have been established in culture for many years. Short exposures (less than 30 min) at 45°C readily kill a large proportion of cells. The response to heat was strikingly similar in all cells tested, and no preferential killing of neoplastic cells could be demonstrated. By contrast, hypoxic cells were found to be dramatically more susceptible to killing by heat than aerated cells. This is the reverse of the situation for x irradiation. The effectiveness of x irradiation was potentiated by treating the irradiated cells for 20 min at 43°C, which did not kill a detectable number of cells. (auth)

859 HYPOXIC SENSITIZERS: RADIOBIOLOGICAL STUDIES AT THE CELLULAR LEVEL. Hall, E. J.; Roizin-Towle, L. (Columbia Univ., New York). Radiology; 117: No. 2, 453-457 (Nov 1975).

The nitroimidazoles have been found to selectively sensitize hypoxic cells to the effects of irradiation. The latest in this family of drugs is RO-07-0582, which is able to mimic 80 percent of the oxygen effect at a concentration of 5 mM by modifying the sensitivity of hypoxic cells to single doses of gamma rays; however, it is not a substitution for oxygen in promoting the repair of sublethal radiation damage between split doses. Studies show that it is a powerful cytotoxic agent as well and selectively operates against hypoxic cells. (auth)

860 MAMMARY CARCINOMA CELL POPULATION GROWTH IN PREIRRADIATED AND UNIRRADIATED TRANSPLANT SITES. Clifton, K. H.; Jirtle, R. (Univ. of Wisconsin, Madison). Radiology; 117: No. 2, 459-464(Nov 1975).

Although preirradiation to the transplant site profoundly depresses growth of subsequently grafted carcinomas, the potential rate of tumor cell population growth was very similar within the viable regions of large and small tumors grafted in preirradiated or unirradiated sites. The vascular space per unit of viable tumor mass has previously been shown to be constant in such viable tumor tissue. It is concluded that the tumor-bed effect is due to suppression of vascular growth capability. Insofar as therapeutic procedures depend on relative functional vascular space, the sensitivity per unit mass of viable tissue would be expected to be very similar in large and small tumors growing in unirradiated or preirradiated sites. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 90, 841, 843, 846, and 850.

861 (AD/A-004205) UV-OZONE WATER OXIDATION/STERILIZATION PROCESS. Final Report, 1 July 1973 - 1 July 1974. Zeff, J. D.; Barton, R. R.; Smiley, B.; Alhadeff, E. (Westgate Research Corp., Marina Del Rey, Calif. (USA)). Sep 1974. 89p. (DADA-17-73-C-3138). NTIS $4.75.

The purpose of this program was to determine the feasibility of purifying water using the combination of ozone and ultraviolet radiation. It was discovered from in-house efforts that this combination of purifying agents was an effective means of removing bacteria and organic contaminants in water. The initial objective of this program was to define the levels of ozone and UV radiation required to destroy predetermined concentrations of microbial contaminants and organic substances in water. These contaminants were representative of those often found in waste water effluents encountered by the Army and NASA. The study was divided into two parallel efforts, a microbiological study and an organic study. The microbiological investigation has shown that the combination of uv and ozone is more effective in destroying E. coli, Streptococcus faecalis, Klebsiella pneumoniae, and Acanthamoeba castellanii than uv or ozone alone. In the organic tests, the test organic compounds selected were hydroquinone, pyrogallol, xylenol, sodium acetate, and urea. (GRA)

862 (SAND-75-0435, pp 68-72) BIOMEDICAL AND ENVIRONMENTAL SUPPORT PROGRAMS. Sep 1975.

In Beneficial Uses program. Progress report [for] period ending June 30, 1975. (Sandia Labs., Albuquerque, N. Mex. (USA)).

Progress is reported on studies on the effects of heat, ionizing radiation, and various combinations of the two on the inactivation of hepatitis viruses in various environments such as blood and sewage sludge. The mutational effects of heat, radiation, and combinations thereof on spore-forming bacteria are being studied and preliminary results are reported from a study of the frequency of auxotrophic mutants observed among the survivors of Bacillus subtilis spores after varying periods of dry-heat treatment. (CH)

863 STUDY OF VARIABILITY OF ASPERGILLUS NIGER PRODUCING CITRIC ACID INDUCED BY SEPARATE AND COMBINED EFFECT OF NITROSOMETHYLUREA AND ULTRAVIOLET LIGHT. Shcherbakova, E. Ya.; Karadzhova, Z. S.; Ermakova, E. P. (Leningradskij Nauchno-Issledovatel'skij Inst. Pishchevoj Promyshlennosti (USSR)). Mikrobiologiya; 43: No. 3, 508-513(May 1974). (In Russian).

For English translation see the journal Microbiology.

The action of μ-v radiation followed by treatment with nitrosomethylurea (0.05%, 3 hr) and μ-v radiation (10×10^3 ergs/mm^2) was used to select a mutant, "Leningrad-1," formed under depth conditions of culturing on molasses media and producing 22% more citric acid and 2-fold less oxalic and gluconic acids than the initial strain. Other methods of combined processing with mutagens, and small doses of nitrosomethylurea were not effective in the selection, e.g., high doses of nitrosomethylurea and μ-v irradiation at a subsequent stage of selection using μ-v radiation. (tr-auth)

864 EFFECT OF RADIATIONS OF FUNGI: II-ULTRAVIOLET RADIATIONS. Osman Nazima; Mohyuddin, M.; Malik, M. A. (West Pakistan Agricultural Univ., Lyallpur). Nucleus (Karachi).; 11: No. 1,2, 19-24(Jan 1974).

47 refs.

Fungi are important biodeterioration agents and the effects of ionizing radiations on them have been reviewed previously. The paper summarizes the effects of non-ionizing radiations, viz., ultraviolet radiations, on the growth and sporulation of different fungi. (INIS)

865 ATOMIC ENERGY AND AGRICULTURE. Upreti, D. C. (Indian Agricultural Research Inst., New Delhi. Cummings Lab.). Vaigyanik.; 6: No. 2, 19-21(Apr 1974). (In Hindi).

Uses of radioisotopes and radiations in agriculture are briefly described such as: development of high-yielding plant mutants; pest control; fertilizer studies; and food preservation. (INIS)

866 THE EFFECT OF Hly PLASMIDE ON THE ULTRAVIOLET INDUCTION OF A PROPHAGE COLICINOGENIC E1 FACTOR. Bryzgunova, N. I.; Likhoded, V. G.; Pyatkin, K. D. (Krymskij Meditsinskij Inst., Simferopol' (USSR); Institut Vaktsin i Syvorotok, Moscow (USSR)). Zh. Mikrobiol., Epidemiol. Immunobiol.; No. 6, 137-138(Jun 1974). (In Russian).

The effect of Hly plasmide on spontaneous and μ-v induced derepression of λ prophage and colicinogenic E1 factor col E1-K30 was studied. With μ-v irradiation in different doses it was shown that the increase in phage production in strains K12S (λ) and K12S (λ) (Hly 195) is greatest for the same dose (20-30 c). However, the number of negative colonies after irradiation compared with non-irradiated in strain K12S (λ) increased on an average 14 times and in strain K12S (λ) (Hly 195), 90 times. Thus the probability of μ-v induced derepression of λ prophage in the presence of plasmide Hly 195 culs is greatly increased. The results show

that the effect of plasmide Hly 195 on derepression of prophage is decreased but its derepression by μ-v radiation is greatly increased. At the same time, plasmide Hly 195 does not affect the frequency of spontaneous production of colicine El_2 but sharply decreases the probability of derepression of colcinogenic factor after μ-v irradiation. The mechanisms of the described phenomena are not known. (tr-auth)

867 COMPARATIVE CHARACTERISTICS OF MUTAGENIC EFFECT OF N-NITROSO-N-METHYLBIUREA AND ULTRAVIOLET LIGHT ON PENICILLIUM CHRYSOGENUM. Zakharova, G. M.; Bartoshevich, Yu. E.; Rapoport, I. A. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Antibiotikov, Moscow (USSR)). Antibiotiki; 19: No. 6, 501-504(Jun 1974). (In Russian).

A comparative study is presented of the effect of a new, chemical mutagenic agent N-nitroso-N-methylbiurea (NMB) and ultraviolet irradiation on Penicillium chrysogenum strain 39 from data on survival, morphological mutability, and induction of biochemical mutations. It was established that with increasing treatment time and dose of mutagenic agent the survival decreases as a rule, while the number of morphologically changed forms increases. The frequency of the appearance of biochemical mutants depends on the dose of mutagenic agent and time of treatment. (tr-auth)

868 NONREPLICATED DNA AND DNA FRAGMENTS IN T4 r⁻BACTERIOPHAGE PARTICLES: PHENOTYPIC MIXING OF A PHAGE PROTEIN. Carlson, K.; Kozinski, A. W. (Univ. of Pennsylvania, Philadelphia). J. Virol.; 13: No. 6, 1274-1290 (Jun 1974).

Conservative phage containing a genome derived from an infecting phage particle which has not undergone replication in the cell but nevertheless has become encapsulated and released in a normal phase particle, are found after infection of Escherichia coli with rII⁻ or rI⁻ mutants under conditions which result in rapid lysis. If such conservative phage are derived from a mixed infection with v^+ and v_1 phage, they display phenotypic mixing of the v gene product (an endonuclease carried in the phage particle). Populations of rI and rII mutant phage grown under conditions of rapid lysis include particles containing short DNA fragments. It is suggested that a "maturation defect", common to rI and rII mutants, but absent in rIII mutants, may account for the encapsulation of non-replicated DNA as well as that of the DNA fragments. (auth)

869 IMMUNOGENIC PROPERTIES OF INFLUENZA A2/HONG KONG/1/68 VIRUS INACTIVATED WITH γ RAYS. Kulevich, E. E.; Kosyakov, P. N. (Inst. of Poliomyelitis and Encephalitis Viruses, Moscow). Vop. Virusol.; 6: 696-700(1974). (In Russian).

Influenza A2/Hong Kong/1/68 virus inactivated with γ rays inoculated intranasally induced formation of antihemagglutinins, complement-fixing and virus-neutralizing antibody as early as 6 days after immunization of animals. The antibody titers were higher in sera than in extracts of the lung and tracheal tissues. A rise in specific antibody titers in the course of immunization correlated with increasing resistance of the immunized animals. γ-ray-inactivated influenza virus adsorbed on red blood cells and eluted from them well. (auth)

870 MECHANISMS OF PROTECTION OF γ-IRRADIATED BACTERIOPHAGE LAMBDA BY PROFLAVINE. Maenhaut-Michel, G. (Univ., Brussels). Int. J. Radiat. Biol.; 27: No. 5, 425-435(May 1975).

The protective effect of proflavine on γ-irradiated bacteriophage and its isolated DNA was investigated under conditions of predominantly indirect or direct effects. In both conditions addition of small amounts of the dye during irradiation of phage or DNA was shown to enhance their biological activity. Protection against indirect effects results probably from extensive scavenging of radioinduced water radicals within the medium. On the other hand the results obtained at −196°C, with irradiated DNA-proflavine complexes, imply the existence of a long-range transfer of the primary radiation damage of DNA towards the intercalated molecules of proflavine. A mechanism for the protective effect of proflavine against the direct effect of ionizing radiation on biologically active DNA is suggested. (auth)

871 STUDY OF THE PROTECTIVE ACTION OF A NUMBER OF RADIOPROTECTORS ON GAMMA IRRADIATION OF PHAGES OF AEROBIC, SPORE-FORMING BACTERIA. Polkhovskii, V. A. (Astrakhan Scientific-Research Inst. of Farming, USSR). Dokl. Akad. Nauk Uzb. SSR; No. 1, 56-57(1975). (In Russian).

Phages of Bac. cereus (5 k, 9 k, and 90 k), Bac. thuringiensis (728), and Bac. subtilis (32) at a concentration of 10^5 to 10^6 particles per ml in bouillon containing 210 to 220 mg% amine nitrogen were given Co-60 gamma doses of 10^4, 5×10^4, 10^5, 3.5×10^5 and 5×10^5 R. Aqueous solutions of beta-mercaptopropylamine (MPA), 5-methoxytryptamine (5-MOT), and s-beta-aminoethylisothiorom-ium (AET) were used as protective agents at a final concentration of 0.1% in the irradiated solution. Phage survival was determined with and without the protective agent being present. It was found that phage survival increased significantly with the presence of a radioprotective agent. MPA was more effective in protecting the phage of Bac. cereus 5 k, while 5-MOT protected the phage of Bac. subtilis 32 better. The protective effect of AET was about the same on all phages. (SJR)

872 SENSITIVITY OF E. COLI PHAGE T_6 TO INACTIVATION BY SELECTIVE INORGANIC RADICALS. Redpath, J. L. (Michael Reese Hospital, Chicago). Int. J. Radiat. Biol.; 27: No. 5, 493-497(May 1975).

Sensitivities of E.coli phage T_6 to the radicals $(CNS)_2^-$ and Br_2^- at pH7 are examined, and the results are compared with those previously obtained for T_7. Differences in the radiosensitive sites on the protein components of the two organisms are discussed. (auth)

873 EFFECT OF PHOTOREACTIVATING LIGHT ON VIRUS INFECTION OF UV-EXPOSED POTOROO CELLS. Lytle, C. D.; Benane, S. G. (Bureau of Radiological Health, Rockville, MD). Int. J. Radiat. Biol.; 27: No. 5, 487-491(May 1975).

Plaque formation by uv-irradiated virus may be increased in uv-irradiated cells. This phenomenon is called uv-reactivation (U.V.R.). U.V.R. has been observed in long-term cultures of monkey kidney cells and rat mammary-tumour cells. To enquire further into the decrease in capacity for plaque formation caused by uv and into U.V.R. in mammalian cells and to investigate the role of photoreactivable lesions in these phenomena, a study with photoreactivating marsupial cells (Cook and Regan (Cook, J. S. and Regan, J. D., 1969, Nature, Lond., 223, 1066)) was undertaken. The results indicate that the plaque-forming capacity was photoreactivable, but that the delayed expression of U.V.R. in Potoroo cells was not greatly changed by photoreactivating light. (auth)

874 INVESTIGATION OF FLAVINOGENESIS OF MUTANTS OF THE YEAST PICHIA GUILLIERMONDII WITH IMPAIRED HEME SYNTHESIS. Shavlovskii, G. M.; Laska, D. V. (Inst. of Biochemistry, Lvov). Microbiology.; 42: No. 4, 607-615(1973).

Translated from Mikrobiologiya; 42: No. 4, 682-687(1973).

Two strains (G. 44 and G. 51) with impaired heme synthesis were produced by treating the yeast Pichia guilliermondii with uv rays. The mutants required δ-aminolevulinic acid (ALA) for growth. In the case of culturing in a medium with a low content of ALA (0.5 μg/ml), the catalase activity, the content of cytochromes, and the respiration rate of cells of both strains were lowered. Cells cultured in the presence of an ALA deficiency accumulated a somewhat larger amount of riboflavin, but there was no oversynthesis of riboflavin in this case. The riboflavin synthetase activity of cells cultured at low and high ALA contents was the same. When washed mutant cells were incubated in a medium without ALA and with ALA, the content of flavins, including flavin adenine dinucleotide, was reduced with a simultaneous decrease in the content of hemoproteins. The rates of flavinogenesis were almost the same in both cases. The isolated strains did not lose their ability for oversynthesis of riboflavin on a medium with a low iron content. The data obtained are evidence that a deficiency of hemin compounds is not the cause of oversynthesis of riboflavin in the yeast P. guilliermondii. (auth)

875 SOME BIOLOGICAL PROPERTIES OF PHAGES OF RHIZOBIUM MELILOTI (OF ALFALFA). Marants, L. A.; Moskalenko, L. N.; Rautenshtein, Ya. I. (Inst. of Microbiology, Moscow). Microbiology.; 42: No. 6, 967-973(1973).

Translated from Mikrobiologiya; 42: No. 6, 1088-1094(1973).

A number of biological properties of 17 phages, specific for nodule bacteria of alfalfa, are described. Among them six phages (Nos. 1, 2, 2a, 4, 5, and 6) were isolated from soil, the remaining 11 from lysogenic cultures of Rhizobium meliloti (of alfalfa). All the phages reproduced on the same sensitive culture Rh. meliloti L5-30, from which the prophage was removed. The experimental phages were distributed into four groups according to morphology of plaques. The phages differed substantially in the morphology of their particles. In certain phagolysates, phage particles of two to three different morphological types were detected, which is evidence of a polylysogenic state of the corresponding cultures. In three phages (Nos. 2, 4, and 6), differing sharply in morphology of particles, the nucleotide composition was studied. Double-stranded DNA of the GC-type was detected in them. Data were cited on the sensitivity of the experimental phages to temperature, osmotic shock, citrates, and ultraviolet. It was concluded that the investigated phages, active against nodule bacteria of alfalfa, are a heterogeneous group. (auth)

876 RADIATION-HEAT SYNERGISM FOR INACTIVATION OF CONIDIA OF ASPERGILLUS FLAVUS. Mohyuddin, M.;

Skoropad, W. P. (Alberta Univ., Edmonton, Canada). Radiat. Bot.; 15: No. 2, 185-189(Jun 1975).

Interaction of heat and radiation treatments on the survival of conidia of Aspergillus flavus was studied, using five different temperatures, ranging from 35°C to 55°C, and five different doses, ranging from 25 to 125 krad. In most combinations these treatments showed a synergistic rather than simply an additive lethal effect. The extent of synergism depended considerably on the sequence in which these treatments were applied. Heating at 45°C, 50°C, or 55°C followed immediately by irradiation was the most effective synergistic combination for the inactivation of conidia. (auth)

877 BACTERIAL MUTATION BLOCKING P2 PHAGE LATE GENE EXPRESSION. Sunshine, M. G.; Sauer, B. (Univ. of Iowa, Iowa City). Proc. Natl. Acad. Sci. U. S. A.; 72: No. 7, 2770-2774(Jul 1975).

A mutant of Escherichia coli strain C has been isolated, called gro_{109}, that blocks bacteriophage P2 propagation by interfering with late gene expression. DNA replication proceeds normally in $P2^+$-infected gro_{109} cells, but late phage proteins are not made. Early P2 mRNA is made in normal amounts, but very little late mRNA can be detected. P2 mutants (P2 ogr) able to overcome the gro_{109} block have been isolated in which synthesis of late P2 mRNA and phage proteins is restored. The gro_{109} mutation is closely linked to the cluster of ribosomal genes at 64 min and is recessive to the wild-type (gro^+) allele. A P2 ogr mutation has been mapped on the left arm of the P2 genome, between the rightmost known late gene (D) and the phage attachment site. P2 ogr can complement $P2^+$ in gro_{109} cells, indicating that ogr codes for a diffusible product. (auth)

878 INDUCIBLE ERROR-PRONE REPAIR IN ESCHERICHIA COLI. Sedgwick, S. G. (Brookhaven National Lab., Upton, NY). Proc. Natl. Acad. Sci. U. S. A.; 72: No. 7, 2753-2757(Jul 1975).

A hypothesis that ultraviolet-induced mutagenesis arises from the induction of an error-prone mode of postreplication repair that requires the $exrA^+$ $recA^+$ genotype has been tested with alkaline sucrose gradient centrifugation coupled with assays of fixation determined by loss of photoreversibility. The inhibitor of protein synthesis, chloramphenicol, added before irradiation, prevented a small amount of postreplication repair and completely eliminated mutation fixation in E. coli WP2/sub s/ uvrA. However, chloramphenicol did not affect strand joining: in uvrA bacteria allowed 20 min of growth between irradiation and antibiotic treatment; in nonmutable uvrA exrA bacteria; and in urvA tif bacteria grown at 42^0 for 70 min before irradiation. These observations indicate that an inducible product is involved in a fraction of postreplication repair and is responsible for induced mutagenesis. (auth)

879 GENETIC AND KINETIC EVIDENCE FOR DIFFERENT TYPES OF POSTREPLICATION REPAIR IN ESCHERICHIA COLI B. Sedgwick, S. G. (Oak Ridge National Lab., TN). J. Bacteriol.; 123: No. 1, 154-161(Jul 1975).

The changes in molecular weight of deoxyribonucleic acid (DNA) synthesized after ultraviolet irradiation of Escherichia coli WP2/sub s/ uvrA, and strains additionally mutant at polA, exrA, recA, and exrA and polA loci, were examined by alkaline sucrose gradient centrifugation. In a repair-deficient uvrA recA strain, the frequency of breaks in newly synthesized DNA was equal to that for pyrimidine dimers in parental DNA. Measurements of the amounts and rates of postreplication repair of these breaks indicate that repair is two to three times faster when DNA polymerase I is present, although almost all breaks are repaired regardless of DNA polymerase I activity. Increased ultraviolet doses lead to an increase in the proportion of breaks remaining unrepaired in uvrA recA, uvrA exrA, and uvrA exrA polA strains. The numbers of unrepaired breaks resemble the numbers expected if repair of one lesion is prevented by proximity of a second lesion. (auth)

880 EXCISION OF THYMINE DIMERS IN VITRO BY EXTRACTS OF BACTERIOPHAGE-INFECTED ESCHERICHIA COLI. Friedberg, E. C.; Minton, K.; Pawl, G.; Verzola, P. (Stanford Univ., CA). J. Virol.; 13: No. 5, 953-959(May 1974).

Extracts of DNA polymerase I defective Escherichia coli infected with phage T4 contain an exonuclease activity that removes thymine dimers from uv-irradiated DNA previously nicked with T4 uv endonuclease. This activity is not expressed if cells are infected in the presence of chloramphenicol. The enzyme has a requirement for divalent cation and is not affected by caffeine, but excision is inhibited in the presence of proflavine. The enzyme is present in all phage T4 mutants thus far examined, including 25 uv-sensitive mutants isolated during the course of the experiments, all of which are defective in the v gene. A similar activity can be detected in cells infected with phages T2, T3, and T6, but not in cells infected with phage T7. (auth)

881 PHOTODYNAMIC INACTIVATION OF ANTIGENIC DETERMINANTS OF SINGLE-STRANDED DNA BACTERIOPHAGE phi X174. Khan, N. C.; Poddar, R. K. (Saha Inst. of Nuclear Physics, Calcutta). J. Virol.; 13: No. 5, 997-1000(May 1974).

Bacteriophage phi X174 when photodynamically inactivated (i.e., when rendered unable to produce plaques as a result of exposure to visible light in air in the presence of proflavine) progressively lost their capacity to bind efficiently with homologous antiserum. Such loss of serum-blocking power was evident with heat-inactivated but not with uv-irradiated phage. The ability of the phages to adsorb to host cells, however, remained practically unaltered even after photodynamic inactivation. It thus appears that photodynamic damages in the so-called "jacket" component of the phi X174 coat proteins are partly responsible for the loss of plaque-forming ability, whereas the "spikes" are either poor antigens or insensitive to photodynamic treatment. (auth)

882 TRANSCRIPTION UNIT MAPPING BACTERIOPHAGE T7. II. Proportionality of Number of Gene Copies, mRNA, and Gene Product. Braeutigam, A. R.; Sauerbier, W. (Univ. of Colorado, Denver). J. Virol.; 13: No. 5, 1110-1117(May 1974).

The effect of uv-irradiation of bacteriophage T7 on in vivo early RNA synthesis has been studied by direct quantitation of the gene-specific RNA transcripts. The results show that the early region of phage T7 is transcribed from left to right as a single unit. Furthermore, gene inactivation, the uv sensitivity of synthesis of gene-specific RNA, and the uv sensitivity of synthesis of the corresponding proteins all follow pseudo first-order kinetics in multiply infected cells, demonstrating a random statistical correlation between both transcriptional sampling of gene copies and translational sampling of the resultant RNA transcripts. In addition, these simple kinetics imply an absence of positive feedback mechanisms compensating for the differential decline of individual early gene products in cells multiply infected with phage T7. (auth)

883 HOST DNA SYNTHESIS-SUPPRESSING FACTOR IN CULTURE FLUID OF TISSUE CULTURES INFECTED WITH MEASLES VIRUS. Minagawa, T.; Nakaya, C.; Iida, H. (Hokkaido Univ., Sapporo). J. Virol.; 13: No. 5, 118-125(May 1974).

Host DNA synthesis is suppressed by the culture fluid of cell cultures infected with measles virus. This activity in the culture fluid is initiated somewhat later than the growth of infectious virus. Ninety percent of host DNA synthesis in HeLa cells is inhibited by culture fluid of 3-day-old cell cultures of Vero or HeLa cells infected with measles virus. This suppressing activity is not a property of the virion, but is due to nonvirion-associated component which shows none of the activities of measles virus such as hemagglutination, hemolysis, or cell fusion nor does it have the antigenicity of measles virus as tested by complement-fixation or hemagglutination-inhibiting antibody blocking tests. Neutralization of the activity of this component is not attained with the pooled sera of convalescent measles patients. This component has molecular weights of about 45,000, 20,000, and 3,000 and appears to be a heat-stable protein. The production of host DNA suppressing factor (DSF) is blocked by cycloheximide. Neither uv-inactivated nor antiserum-neutralized measles virus produce DSF. Furthermore, such activity of nonvirion-associated component is not detected in the culture fluid of cultures infected with other RNA viruses such as poliovirus, vesicular stomatitis virus, or Sindbis virus. (auth)

Radiation Effects on Plants

Refer also to abstracts 615, 864, and 865.

884 (RT/PROT-(75)11) RESULTS AND PERSPECTIVES OF MUTAGENESIS APPLIED TO DURUM WHEAT. Bagnara, D. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). May 1975. 80p. Dep. NTIS (US Sales Only) $6.00.

A review is made of the main aspects and problems of mutagenesis applied to the breeding of durum wheat (Triticum turgidum ssp. durum). Features and type of action of ionizing radiations and chemical mutagens are considered; a comparison is also made between the two classes of mutagens, on the basis of results so far achieved. Mention is, then, made of: methods of treatment; parts of plant which can be treated; growing of treated material in segregating generations; data to be successively recorded. Methods of estimation of frequency of mutations and the problem of arising of chimerical tissues, together with its possible overcoming, are also discussed. Examination is made of some special effects of mutagens, namely: induction of translocations; diploidization of

polyploids; induction of haploids and aneuploids; genetic analysis of specific loci; induction of male sterility. Finally, results are reviewed, concerning induction and utilization, either as varieties or in cross breeding programs, of mutants for characters of agronomic interest. (auth)

885 EFFECTS OF GAMMA RADIATION ON CERTAIN CHARACTERS OF SOYABEAN. Vasti, S. M.; Keerio, G. R. (Atomic Energy Agricultural Research Centre, Tandojam (Pakistan)). Nucleus (Karachi).; 11: No. 1,2, 39-42(Jan 1974). 6 refs.

Effects of gamma radiations were studied on two varieties of soybean viz., Coker-240 and improved pelican. The dosages were 250, 500, 1,000, 2,000, 2,500, 3,000, 5,000, 7,500, 10,000, 12,500, 15,000, 20,000, 30,000, and 40,000 roentgen (R). The data on mean seedling height, plant height, number of pods per plant yield, etc., indicate that gamma radiation dose from 15,000 R to 40,000 R would be quite effective for production of variability in this crop. No low dose stimulation was observed under the conditions of this experiment. (auth)

886 SELECTION FOR QUANTITATIVE CHARACTERS IN THIRD GENERATION AFTER SEED IRRADIATION IN COTTON. Nazir, C. M.; Khan, M. S. I. (West Pakistan Agricultural Univ., Lyallpur). Nucleus (Karachi).; 11: No. 1,2, 33-38(Jan 1974). 13 refs.

A large-bolled line, R-7 selected in M_2 generation after seed irradiation of cotton variety AC-134, was grown and tested in M_3 generation. Seventeen progenies of R-7 in M_3 and control plants of variety AC-134 were used to compare yield, boll size, seed lint indices. Data of 17 progenies of R-7 were analyzed in order to estimate the varianced, correlation coefficients, heritability and selection advance. Significant amounts of genetic variability were present for yield and seed index. Genetic variance values for boll size and lint index were very low. Similarly, heritability estimates for yield and seed index were more than 0.75 and those for boll size and lint index less than 0.50. Boll size and seed index were found genetically correlated. Selection for higher yielding genotypes was found passible. Induced variation was utilized by selection, and some variation is still left for further progress. (INIS)

887 RADIATION-INDUCED CHROMOSOMAL ABERRATIONS IN THE PLANT TRADESCANTIA: DOSE-RESPONSE CURVES. I. Preliminary Considerations. Savage, J. R. K. (Medical Research Council, Harwell, Eng.). Radiat. Bot.; 15: No. 2, 87-140(Jun 1975).

The biological, cytological, and radiobiological characteristics of Tradescantia are surveyed, and some of the problems associated with obtaining dose-response curves for radiation-induced structural chromosome aberrations are outlined in an extensive review. Apparently insurmountable difficulties hinder the acquisition of reliable and interpretable quantitative date for chromatid-type aberrations, but some of the wide range of qualitative data available for chromatid-type aberrations have been included. (UK)

888 EFFECT OF CHRONIC GAMMA IRRADIATION ON DECAY OF OAK (QUERCUS PUBESCENS WILLD) AND DOGWOOD (CORNUS MAS. L.) LEAVES AND SUBJACENT LITTER. Saas, A.; Bovard, P.; Grauby, A. (CEN de Cadarache, Saint-Paul-les-Durance, France). Radiat. Bot.; 15: No. 2, 141-151 (Jun 1975).

Experiments showed that ionizing radiation increased decay of leaves and caused greater release of organic compounds (9 to 20 per cent, depending on the species, relative to carbon content) and mineral elements (20 to 50 per cent depending on the species and the element considered). The irradiated samples also showed substantial lowering of water storage capacity, variation in the free radicals (in particular phenolics and carbonylics) and in the release of organic compounds. The effect on the soil surface horizons was an enhancement of leaching of organic and mineral compounds (fulvic acid and accelerated manganese and zinc). Humus loss was 8 to 10 per cent per annum in the surface horizon and 3 to 5 per cent in the subjacent horizon. (auth)

889 EFFECT OF IONIZING RADIATION ON RIBOSOMAL RNA SYNTHESIS IN GRAND RAPIDS LETTUCE SEEDS. Yealy, L. P.; Stone, B. P. (Austin Peay State Univ., Clarksville, TN). Radiat. Bot.; 15: No. 2, 153-159(Jun 1975).

Germination of Grand Rapids lettuce seeds was effectively delayed by exposure to 100 kiloroentgens (kR) gamma irradiation. Both gibberellic acid and kinetin were able to slightly overcome this delay in germination imposed by ionizing radiation. Incubation in 5-fluorouracil significantly depressed germination in irradiated seeds while it did not affect unirradiated seeds. A dose of 100 kR ionizing radiation was effective in decreasing incorporation of [^{3}H]-uridine into high molecular weight RNA but did not decrease incorporation into transfer RNA. 5-Fluorouracil reduced incorporation of labeled precursor into both RNA components while gibberellic acid stimulated the synthesis of ribosomal and transfer RNA. The results indicated that ribosomal RNA synthesis was not necessary for germination to occur as 5-fluorouracil did not prevent germination in unirradiated seeds. However, 5-fluorouracil did delay germination after exposure to ionizing radiation indicating that ribosomal RNA synthesis may be involved in radiation damage and subsequent repair processes. From these data it appeared that ionizing radiation delayed germination of Grand Rapids lettuce seeds through an inhibition of ribosomal RNA synthesis. (auth)

890 OXYGEN ENHANCEMENT RATIOS (OERS) FOR SOMATIC MUTATIONS IN TRADESCANTIA STAMEN HAIRS. Underbrink, A. G.; Sparrow, A. H.; Sautkulis, S.; Mills, R. E. (Columbia Univ., New York). Radiat. Bot.; 15: No. 2, 161-168(Jun 1975).

Oxygen enhancement ratios (OERs) were determined for pink mutations in stamen hairs of Tradescantia clone 02. These were determined for x rays (OER of 3·2) and neutrons at six energies ranging from 0.395 to 13.4 MeV (OERs ranging from 1.32 to 1.68). Unlike RBE, OER values showed only a slight dependence on neutron energy and were not found to vary as a function of dose. Our results appeared consistent with OERs generally reported from other systems, but at certain energies did not agree with results previously reported for Tradescantia. (auth)

891 PRACTICAL MERIT OF DELAYED SELECTION AFTER SINGLE AND RECURRENT MUTAGENIC TREATMENTS. II. Optimum Generation for Selection. Yonezawa, K.; Yamagata, H. (Kyoto Univ.). Radiat. Bot.; 15: No. 2, 169-184(Jun 1975).

Criteria for predicting optimum selection procedure in mutation breeding of self-pollinating crops were discussed and formulated. Based on the mathematical formulae and some numerical computations, the efficiency of delayed selections was examined and the following derived as a general conclusion. Delayed selection in $M_3 \sim M_5$ generations is of great practical merit when plants mutated at multiple loci are to be obtained. This method is considered promising even for the detection of single-locus mutants when difficulty in discrimination of the objective mutants is large, and/or when permissible population size per generation is small, probably below 10,000, as a rough estimate. It is, in general, thought that fifteen or more M_2 plants should be derived per M_1 spike or panicle. Small progeny size per M_1 spike such as one, two, or three as proposed by Yoshida et al. (Yoshida, Y., Tsuru, M., and Kitahara, S., 1969, Radiat. Bot., 9, 15) seems of limited utility. (auth)

Radiation Effects on Animals

Refer also to abstract 564.

Man

Refer also to abstracts 630, 1421, 2207, and 2212.

892 (AAEC/IP-8) HEALTH AND SAFETY RECORD OF THE NUCLEAR INDUSTRY. Carter, M. W.; Carruthers, E.; Button, J. C. E. (Australian Atomic Energy Commission, Coogee). Sep 1975. 24p. Dep. NTIS (US Sales Only) $4.25.

The claim of the nuclear industry to have an excellent safety record is examined in terms of health and accident records of workers in the industry. Accidents which have not resulted in harm to the workers' health are not considered. The nuclear industry is considered to include all work with ionizing radiations and radioactive materials, in education, research, medicine and industry. Since "safety" is not an absolute concept, comparisons are made with the published records of other industries, and a study is made of the performance of the nuclear industry in relation to its own safety criteria. Data are presented on the radiation exposure of nuclear workers in Europe, America, India and Australia, in relation to the internationally recommended limits, and there is some discussion of the risks involved in these limits. The death rate in parts of the nuclear industry in America, the United Kingdom, and Australia is presented and compared with the death rate for other industries in those countries, and a listing is made of deaths caused by radiation in the period 1945 to 1968. Injury rates for the US and Australian nuclear industries are also compared with the injury rates for other industries in these countries. Consideration is given to the safety record of individual components of the nuclear industry (using the wide definition of this industry given above), special attention being given to health records of uranium miners, plutonium workers and radiologists. Although there are difficulties in obtaining sufficiently detailed

information of this kind it is considered that the data presented, relative to any reasonable standard, demonstrate that the nuclear industry has a safety record to be proud of. (auth)

893 (CONF-750443-4) REPAIR OF HUMAN DNA: RADIATION CHEMICAL DAMAGE IN NORMAL AND XERODERMA PIGMENTOSUM CELLS. Regan, J. D.; Setlow, R. B. (Oak Ridge National Lab., Tenn. (USA); Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 27p. Dep. NTIS $4.50.

From conference on the biology of radiation carcinogenesis; Gatlinburg, Tennessee, USA (7 Apr 1975).

The photolysis of bromodeoxyuridine (BrdUrd) incorporated during repair was used for the assay of DNA repair in human cells. This assay supplies a characterization of the sequence of repair events that occur in human cells after radiation exposure, both ultraviolet and ionizing, and permits an estimation of the size of the average repaired region after these physical insults to DNA. Chemical insults to DNA are discussed and an attempt is made to liken the repair processes after chemical damages of various kinds to those repair processes that occur in human DNA after damage from physical agents. Results are reported indicating that, under certain conditions, repair events resembling those seen after uv radiation can be observed in normal human cells after ionizing radiation and that xeroderma pigmentosum cells, defective in the repair of uv-induced DNA damage, show defective repair of these uv-like DNA lesions induced by ionizing radiation. (CH)

894 (CONF-750738-1) MEASUREMENT OF MAN'S EXPOSURE TO EXTERNAL RADIATION. Becker, K. (Oak Ridge National Lab., Tenn. (USA)). 1975. 25p. Dep. NTIS $4.25.

From second Latin-American conference on medical physics and radiation protection; Belo Horizonte, Brazil (Jul 1975).

After outlining briefly the rationale for personnel radiation monitoring with integrating detectors, a review is presented of some developments which have taken place in personnel and environmental dosimetry during the past 3.5 years. The results of a pilot field experiment concerning the stability of film and thermoluminescent dosimeters (TLDs) in four Latin-American countries are summarized. It shows that film dosimeters should be used only with caution, and in locations with a moderate climate. A survey is being conducted on the current status and trends in personnel monitoring, involving detailed questioning of over 150 laboratories in about forty countries to obtain information on the type of service and detectors, evaluation and recordkeeping, additional applications, problem and development areas, intercomparisons, practical experiences with different systems, administrative and legal aspects, etc. According to the preliminary results, the trend is away from photographic film and towards mostly automatic TLD systems, not only in the industrialized countries but also in several of the larger and more advanced developing countries. The need for higher quality standards and frequent performance tests under realistic conditions is emphasized. Differences in the requirements for personnel and stationary environmental dosimeters are outlined. As evidenced by the results of a recent international intercomparison of such dosimeters under laboratory and field conditions, involving 56 dosimeter sets from eleven countries, reasonably accurate results can be obtained with several TLD systems including LiF, $CaSO_4$:Dy, and CaF_2:Mn; however CaF_2:Dy is less reliable than the others and film is not adequate at all. Transit doses were found to be erratic and frequently high. Limitations in the assessment of population doses from stationary detector readings are discussed. (auth)

895 (FDA-76-8001) PUBLIC HEALTH IMPLICATIONS OF RADIOLUMINOUS MATERIALS. Moghissi, A. A.; Carter, M. W. (Georgia Inst. of Tech., Atlanta (USA). Office of Interdisciplinary Programs). Jul 1975. Contract 233-74-6093. 52p. GPO.

This study evaluates the safety, efficacy, and relative merits of commonly used radioluminous materials. A comparative risk benefit analysis is carried out for radium-226, promethium-147, and tritium. These materials have been used most extensively in the dial painting industry for the illumination of timepieces and other instruments where self illumination offered an advantage. The study concludes that radium should not be used for dial painting because tritium can be used to accomplish the same results with substantially less exposure. Before a large-scale application of promethium-147, methods must be developed to determine the body burden of workers as a result of occupational exposure. (auth)

896 (INIS-mf-1236, pp 73-90) FORMATION AND PHYSICAL PROPEPERTIES OF LOCAL FALLOUT CAUSED BY NUCLEAR EXPLOSION. Mamont-Ciesla, K. (Centralne Lab. Ochrony Radiologiczne), Warsaw). 1972. (In Polish).

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In Radioactive pollution of environment. (Centralne Lab. Ochrony Radiologiczne), Warsaw (Poland)).

Local fallout is one of the destroying effects of nuclear weapon detonations. The range of local fallout is much bigger than the total destruction zone due to a nuclear weapon. Radiological protection of the public in a nuclear war is mainly connected with local fallout hazard. In the particle formation, distribution and deposition process of fallout particles and their characteristics are described in short form. Size, shape, color, density, activity and ferromagnetic properties of fallout particles for three different types of burst are summarized. Some of spectral characteristics of local fallout are described. (INIS)

897 (INIS-mf-1374) TASKS BEFORE THE COUNTRY IN THE FIELD OF RADIATION PROTECTION. Gopal-Ayengar, A. R. (Bhabha Atomic Research Centre, Bombay (India)). 12 Apr 1973. 8p. (CONF-730495-6). INIS.

From 1st annual conference of Indian Association for radiation protection; Bombay, India (12 Apr 1973).

A review of national radiation protection program in India is presented. The importance of early education and training of personnel and provision of technical and advisory services rather than legislature measures is stressed. Public education is considered as important, particularly in a developing country. The task of formulating national standards and specifications on various aspects of radiation protection is touched upon. Professionalization of radiation protection personnel and training programs for radiation users is emphasized. (INIS)

898 (INIS-mf-1703, pp 355-366) POPULATION DOSE. Belyaev, V. A. 1974. (In Russian).

From Jubilee conference dedicated to the twentfeth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

This paper considers methods of calculating the population dose created by atomic reactor wastes. In this case the authors take into account both irradiation of the local population and also irradiation of the population in more remote regions, where food products grown near the reactor are required. The units of measuring the population dose are also discussed. A concrete example is presented for calculating the contribution to the population dose from KRG isotopes, ^{131}I and ^{137}Cs. (tr-auth)

899 (SSI--1974-032) CLOSE SITING OF NUCLEAR POWER PLANTS. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Nov 1974. 14p. (In Swedish). Dep. NTIS (US Sales Only) $4.00.

The part of the report "Close Siting of Nuclear Power Plants" (Statens Offentliga Utredningar 1974:56) concerning possibilities of radiation damages in the environment after a reactor accident is discussed. The calculation model used for calculation of consequences of an accident under different meteorological conditions is criticized, as well as the calculation of the number of late radiation damages. The report is also criticized for not having payed enough attention to slight radiation damages in the calculations of total risks. (auth)

900 (TID-26676) ATLAS OF RADIATION HISTOPATHOLOGY. White, D. C. (Armed Forces Inst. of Pathology, Washington, D. C. (USA)). 1975. 236p. Dep. NTIS $7.60.

Ionizing radiation has become a highly effective means of combating cancer. In many forms of this disease, therapeutic irradiation, as the sole definitive treatment, has been capable of controlling or substantially retarding the spread of the malignancy. In certain circumstances both primary and metastatic growths have been destroyed. The characteristics that endow ionizing radiation with its remarkable tumoricidal propensities at the same time cause damage to nontumorous tissues within the radiation field which can eventuate severe patient distress and disability. The nature of the response of these organized tissues is regulated by innumerable factors, inherent and conditional, each tissue type reacting according to a pattern determined largely by the relative radiosensitivities of its diverse, integrated cell populations. The times from exposures at which these often clinically significant responses become evident and the ways in which they adversely affect the health and well-being of the patients are of considerable interest and importance to the therapeutic radiologist since these parameters often control dose limitation in treatment planning. The fundamental purpose of the atlas is to briefly delineate and describe those morphologic effects which are associated with the actions of ionizing radiation in diverse tissues and to correlate those observations with the physiological constitution of the involved tissue, certain physical characteristics of the applied radiation, and the times through which specific responses develop. (auth)

901 INFLUENCE OF INBORN CHROMOSOMAL ABNORMALITIES ON POST-RADIATION CHROMOSOMAL CHANGES IN MOSAIC. Kucerova, M.; Lauder, I. (Ceskoslovenska Akademie Ved, Prague. Ustav Experimentalni Biologie a Genetiky); Evans, H. J. (Western General Hospital, Edinburgh (UK)). In Vitro CSSR.: 2: No. 2B, 150-156(1974). (In Czech).

From 5th annual meeting of the Cytogenetic Section of the Czechoslovak Biological Society of the Czechoslovak Academy of Sciences; Hradec Kralove, Czechoslovakia (20 Sep 1972). Available by Ceskoslovenska Biologicka Spolecnost pri CSAV, Hradec Kralove, Czechoslovakia.

Blood samples of patients with the mosaics 46,XY/47, XY, 21^{+} and 46,XY/47, XYY were irradiated with 200 R of X rays and cultivated for 45, 48, 51, 54, 57, and 60 hours. A cytogenetic analysis showed that over the cultivation time trisomic and YY cells started mitosis at the same time as normal cells. A significantly higher proportion of cells with chromosomal aberrations, namely dicentrics and rings, was found in cells with trisomy 21 compared with YY cells and normal cells. (INIS)

902 ACUTE RADIATION SICKNESS INDUCED BY GAMMA-NEUTRON IRRADIATION. Glazunov, I. S.; Blagoveshchenskaya, V. V.; Ivanov, V. A.; Malakhova, V. V. Klin. Med. (Moscow); 52: No. 4, 55-61(Apr 1974). (In Russian).

A number of studies have shown the clinical picture of acute radiation sickness due to gamma-neutron irradiation. The duration of the condition has been described. The dependence of the clinical picture on the dose, the half-life of the radiation, the geometry of the irradiation, and the type of ionizing radiation has been demonstrated. (INIS)

903 EXPOSURE TO X-RAYS IN DIAGNOSTIC RADIOLOGY. Sowby, F. D. World Health Organ. Chron.; 28: No. 7, 333-335 (Jul 1974).

Recommendations of the ICRP are discussed with regard to the need to protect the patient; the balance between benefit and risk; dissemination of ICRP recommendations; exposures of tissues; and means of dose reduction. Observations on the current situation are discussed with regard to frequency of examinations, type and purpose of examinations, radiological techniques, and dose per examination. (HLW)

904 HEAVY PARTICLE RADIOTHERAPY. Watanabe, T. Rinsho Hoshasen; 19: 317-328(Apr 1974). (In Japanese).

905 COMPUTATION OF ABSORBED DOSE DISTRIBUTION IN ^{60}Co TELETHERAPY. Cuzino, S. (Inst. of Atomic Physics, Bucharest); Moldovan, N.; Szakats, M.; Matache, G. Rev. Roum. Phys.; 20: No. 1, 107-113(1975).

The treatment planning in radiotherapy needs the knowledge of absorbed doses in the depth of irradiated tissue. In this paper a simple and rapid method for the computation of absorbed doses is presented. The results of experiments are also presented and the good agreement was obtained, maximum deviation being of 10 percent. (auth)

906 EXAMINATIONS OF DOSE DISTRIBUTION FOR THE IRRADIATION OF MALIGNANT RENAL TUMORS WITH ULTRAHARD BREMSSTRAHLUNG FROM A 28 MeV BETATRON BY THREE STATIONARY FIELDS. Stecher, M.; Arndt, J.; Kob, D.; Kloetzer, K. H. (Univ., Jena, Ger.). Radiobiol. Radiother.; 16: No. 3, 279-290(1975). (In German).

There is a favorable dose distribution for the radiation therapy of malignant renal tumors using ultrahard bremsstrahlung from a betatron when the main portion of the dose is irradiated through a field tilted 45° frontally backwards and the remaining portion is irradiated through an opposite field and a dorsal renal field. Dose distribution should be such that integral dose is as low as possible to keep side-effects as low as possible. Directions are derived how the dose is to be distributed in dependence on individual patient measures in order to obtain a minimum integral dose. The method does not require expensive accessories especially computers and is not only limited to the irradiation of renal tumors and to the use of ultrahard bremsstrahlung. These directions are discussed by an anatomical model based on patient measures. The advantage of optimum dose distribution is shown to lie not only in the lowest integral dose but also in a maximum dose concentration to the tumor region. These advantages are important for adipose patients and become less with decreasing stoutness of the patients. (auth)

907 DEPENDENCE OF INTESTINAL RADIATION RESPONSES ON TEMPORAL AND SPATIAL DOSE DISTRIBUTION IN RADIATION THERAPY OF ABDOMINAL TUMORS. Neumeister, K.; Kamprad, F. (Karl-Marx Univ., Leipzig). Radiobiol. Radiother.; 16: No. 3, 291-298(1975). (In German).

Analysis of the frequency of acute intestinal radiation responses to radiation therapy of abdominal tumors (gynaecological tumors, renal tumors, testicular tumors, bladder tumors et al.) gives evidence of a significant connection with temporal and spatial dose distribution in the abdominal region. In this paper the results on the dependence of radiation-induced intestinal disturbances on fractionation in abdominal irradiation is communicated. Reaction of weight to abdominal irradiations only limitedly gave evidence of a dependence on temporal and spatial dose distribution. Such a connection is hinted in the impairment of intestinal absorption capacity (model: D-xylose test). (auth)

908 CONTRIBUTION TO THE PROBLEM OF RADIATION RISK IN MEDICAL RADIOLOGY. Herlbauer, R. (Hauptstrahlenschutzbeauftragter des Medizinische Bereiches, Halle, Ger.). Radiobiol. Radiother.; 16: No. 3, 299-310(1975). (In German).

The increasing civilisatory radiation exposure (especially the extension of radiodiagnostics) anew actualizes the problems of radiation protection and makes the present limits uncertain, so that an assessment of risk analyzing the present situation by means of data in literature seems to be reasonable. Unchangedly noticing the genetic risks somatic alterations as to carcinogenesis and leukaemia induction, respectively, are now well to the fore of considerations. In modern radiology is the diagnostical area and in the treatment of benign diseases somatic damages have not to be feared for all persons concerned, whereas they have to be accepted in the therapy of malignant tumors for vital indication. So far genetic changes are not demonstrable below 10 rem. In occupational radiation exposure the occurrence of damage is extremely improbable; if possible, however, the accumulation of this dose by the patient within its generation period has to be avoided. In radiodiagnostics as main source of risk the gonad dose can be often decreased by 2 powers of ten; at present, however, the possibilities available are only imperfectly utilized. Clinical radiology has to search for new ways together with physics, technical science, and radiation biology within a systematic solution of the problem of radiation protection in order to meet and possible to reverse the increasing genetic pressure to population without relevant losses of diagnostic information and therapeutic effect. (auth)

909 FERTILITY DISTURBANCES FOLLOWING TREATMENT OF PATIENTS WITH TESTICULAR TUMORS. Weissbach, L.; Lange, C. E.; Rodermund, O. E.; Zwicker, H.; Gropp, A.; Pothmann, W. (Urologische Universitatsklinik, Bonn). Urologe; 13: 80-85(Mar 1974). (In German).

The treatment of testicular tumors can cause fertility disturbances. The patients in the young age group should be informed prior to surgery about the occurring infertility. 33 out of 37 patients (90%) who underwent lymph node dissection developed aspermia, caused by an interruption of the ejaculation reflex arc. The first phase of the ejaculation—the transportation of the sperm into the posterior urethra—fails to take place. Cytostatic drugs and irradiation result in partly irreversible damages of the germinal epithelium as demonstrated by biopsy of the testicles and by semen analysis. Only one of the 53 patients, having been operated or irradiated, fathered a child. There is no justification for limiting radical treatment and possible cure because of damage to the reproductive system. The patient has to be informed adequately. Precautions have to be taken to protect the remaining testicle during the irradiation. In addition the patient should be advised concerning possible semen storage prior to lymph node dissection and cytostatic treatment. (auth)

910 RADIOBIOLOGICAL CONSIDERATIONS FOR PIONS IN RADIOTHERAPY. Feola, J.; Maruyama, Y. (Univ. of Minnesota, Minneapolis). Oncology; 25: 536-557(1971).

A new radiation beam, the π^{-} meson beam, is being considered for radiotherapy of human neoplasms. It is clear that this beam has special attributes which make it useful in certain types of neoplasms. However, human experience is heavily based upon low LET beams, alterations of dose rate, and treatment planning to confine dose to required therapeutic volumes. The use of this new beam must be considered upon existing knowledge regarding the natural history of the neoplasms, and the expected biological properties of the pion beam. It is likely that revision of present fractionation schedules will be required but most likely the pions will be useful to treat the residual tumor core of a tumor reduced in size by prior external beam, low LET therapy. (auth)

911 PHASE 1 STUDY OF HIGH-DOSE METRONIDAZOLE: A SPECIFIC IN VIVO AND IN VITRO RADIOSENSITIZER OF HYPOXIC CELLS. Urtasun, R. C.; Chapman, J. D.; Band, P.; Rabin, H. R.; Fryer, C. G.; Sturmwind, J. J. (Univ. of Alberta, Edmonton). Radiology; 117: No. 1, 129-133(Oct 1975).

Metronidazole was administered orally to 25 patients and its maximum concentration in blood and tumor tissues, its ability to cross the blood/brain barrier and concentrate in the cerebrospinal fluid and brain tumor tissue, its immediate and long-term toxicity,

and its enhancement of irradiation in normal tissue were studied. Maximum blood concentrations of 700 to 1200 mu M (120 to 220 mu g/ml) were obtained at four hours with doses of 6 g/m^2. Moderate and transient nausea and vomiting were the only immediate signs of toxicity. No long-term toxicity was found up to 18 months after administration of the drug. These data indicate that metronidazole can feasibly be administered in clinical trials of fractionated radiotherapy using dosages ranging from 9.5 to 11 g three times a week for three to four weeks. (auth)

912 RADIOLOGICAL MANIFESTATIONS OF RADIATION-INDUCED INJURY TO THE NORMAL UPPER GASTROINTESTINAL TRACT. Goldstein, H. M.; Rogers, L. F.; Fletcher, G. H.; Dodd, G. D. (Univ. of Texas, Houston). Radiology; 117: No. 1, 135-140 (Oct 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Radiation-induced injury to the normal esophagus, stomach, and duodenum in patients with advanced cervical carcinoma who received high para-aortic lymph-node irradiation to an average tumor dose of 5,000 rads is discussed. Radiation esophagitis is usually the result of mediastinal irradiation for bronchogenic carcinoma. The most consistent radiological finding is abnormal motility, with esophageal stricture and/or ulceration occurring less frequently. Radiation gastritis is usually present as pyloric ulceration or irregular contractions of the antrum, simulating gastric carcinoma. Postbulbar duodenal mucosal thickening, ulceration, and strictures may occur. Pertinent clinical features, pathogenesis, and pathological correlations are discussed. (auth)

913 COMBINED RADIOSENSITIZER INFUSION AND IRRADIATION OF OSTEOGENIC SARCOMAS. Goffinet, D. R.; Kaplan, H. S.; Donaldson, S. S.; Bagshaw, M. A.; Wilbur, J. R. (Stanford Univ., California). Radiology; 117: No. 1, 211-214 (Oct 1975).

Three children with osteogenic sarcomas which were either unresectable or whose parents refused permission to amputate were treated with combined intra-arterial 5'bromodeoxyuridine (BUdR) infusion and high-dose-per-fraction megavoltage irradiation to the primary site. Pulsed, 48-hour BUdR infusions were performed prior to each 600-rad radiation therapy fraction, with a total radiation dose to the primary site of 4,200 to 4,800 rads in five weeks. Local control was obtained in all 3 children. One child is alive two years after treatment, another died with metastatic disease, and the third patient who received radiotherapy to the lungs for pulmonary metastases is without evidence of disease one year later. (auth)

914 RUPTURE OF MAJOR VESSELS AFTER RADIATION. Fajardo, L. F.; Lee, A. (Veterans Administration Hospital, Palo Alto, CA). Cancer; 36: No. 3, 904-913(Sep 1975).

Rupture of irradiated large vessels is an uncommon complication which tends to occur in carotid, aorta, and femoral arteries, in decreasing order of incidence. It particularly affects men subjected to surgery and radiotherapy for epidermoid carcinomas in oropharynx, esophagus, or genitalia. Contrary to some opinion, radiation is not the most significant cause; this spontaneous arterial rupture can occur without radiation. The perforation is not associated with tumor invasion of arterial wall, as has been claimed. Surgical complications, especially necrosis of skin flaps, infection, and fistulas are most important etiologically. Only 2 of the 11 instances that we describe appear to have been caused mainly by radiation. The perforation is usually fatal, but several patients, including 3 of our series (2 carotid, 1 femoral), have been saved by hospital personnel aware of this complication. To prevent it, prolonged exposure or infection of arteries, whether irradiated or not, should be avoided. (auth)

915 HYPERKALEMIA COMPLICATING SPLENIC IRRADIATION OF CHRONIC LYMPHOCYTIC LEUKEMIA. Kurlander, R.; Stein, R. S.; Roth, D. (Univ. of Chicago). Cancer; 36: No. 3, 926-930(Sep 1975).

Hyperkalemia is an infrequent complication of the therapy of malignant disease. In previously reported cases, hyperkalemia following the institution of chemotherapy has been associated with acute renal failure. In this report, we present a patient with chronic lymphocytic leukemia who developed hyperkalemia following splenic irradiation. Necrosis of tumor cells, either as direct or an abscopal effect appears to be implicated as a cause of hyperkalemia. It seems appropriate to monitor potassium levels when therapy of a responsive tumor is instituted. (auth)

916 EFFECTS OF THERAPEUTIC RADIATION ON COLONIC MUCOSA. Weisbrot, I. M.; Liber, A. F.; Gordon, B. S. (Veterans Administration Hospital, Bronx, NY). Cancer; 36: No. 3, 931-940(Sep 1975).

Low to moderate doses of therapeutic irradiation are capable of producing bizarre cytologic changes in the mucosal cells of colorectal crypts. This may be associated with eosinophilia of the lamina propria and with eosinophilic crypt abscesses. The bizarre cells generally line intact crypts and do not exhibit invasive behavior. The change subsides within 1 to 2 months at the dose levels studied (approximately 2000 rads). (auth)

917 RADIATION CARCINOGENESIS. Son, Y. H. (Yale Univ., New Haven). Cancer; 36: No. 3, 941-945(Sep 1975).

Accidental or therapeutic exposure to radiation may induce tumors of various histologic types in human beings as well as in animals. Two tumors in this report arose in the organs which had been included in the field of radiation 32 and 8 years before, respectively. The author briefly reviews the literature, which abounds with references to radiation carcinogenesis. (auth)

918 RADIATION-ADRIAMYCIN INTERACTIONS: PRELIMINARY CLINICAL OBSERVATIONS. Cassady, J. R.; Richter, M. P.; Piro, A. J.; Jaffe, N. (Harvard Medical School, Boston). Cancer; 36: No. 3, 946-949(Sep 1975).

This communication reports four patients treated with the anthracycline adriamycin and irradiation either concurrently or sequentially, who demonstrated apparent augmentation of radiation reactions. Two of these patients demonstrated the so-called recall phenomenon. (auth)

919 CASE OF HYPERPARATHYROIDISM ASSOCIATED WITH RADIATION TO THE HEAD AND NECK AREA. Rosen, I. B.; Strawbridge, H. G.; Bain, J. (Mount Sinai Hospital, Toronto). Cancer; 36: No. 3, 1111-1114(Sep 1975).

Hyperparathyroidism due to a hyperfunctioning parathyroid adenoma developed in a 57-year-old woman exposed to radiation for facial hirsutism, in whom other tumors of the head and neck had occurred. The details of history and the implications of causal relationship are presented. (auth)

920 ANTICIPATION OF DENTAL ANOMALIES INDUCED BY RADIATION THERAPY. Guggenheimer, J.; Fischer, W. G.; Pechersky, J. L. (Univ. of Pittsburgh). Radiology; 117: No. 2, 405-406(Nov 1975).

Therapeutic irradiation of the head and neck of children up to the age of 16 years can cause malformation and developmental arrest of the permanent teeth. Dental anomalies occurring after irradiation of the palatal tumor in an 8-year-old are described and compared with a normal 8-year-old's developmental sequence to demonstrate that the immature, noncalcified dental structures are most susceptible to radiation injury. The stage of dental development at the time of therapy may be precisely determined by a routine oral radiographic survey, which provides a reliable estimate of the deformation that may be anticipated following radiotherapy. (auth)

921 RADIATION-RELATED EOSINOPHILIA: CORRELATION WITH DELAYED HYPERSENSITIVITY, LYMPHOCYTE COUNT, AND SURVIVAL IN PATIENTS TREATED BY CURATIVE RADIOTHERAPY. Ghossein, N. A.; Bosworth, J. L.; Stacey, P.; Muggia, F. M.; Krishnaswamy, V. (Albert Einstein Coll. of Medicine, Bronx, NY). Radiology; 117: No. 2, 413-417(Nov 1975).

Abdominal irradiation may produce eosinophilia. The relationship between radiation-related eosinophilia (RRE), reactivity to 2-4 dinitrochlorobenzene (DNCB), lymphocyte count, and prognosis was evaluated in 98 patients irradiated for tumors below the diaphragm. Forty-two percent manifested RRE and 62 percent reacted to DNCB. Fifteen of 19 (79 percent) reactors who had RRE were disease-free at 6 months. Fourteen of 22 (64 percent) nonreactors who had RRE and 26 of 42 (62 percent) DNCB reactors without RRE were controlled. Fourteen of 15 (93 percent) nonreactors without RRE had disease at 6 months. Those who had RRE had double the median survival of those who did not. (auth)

922 X-RAY MACHINES FOR AIRPORT SECURITY. Holder, L. E. (Cincinnati General Hospital). J. Am. Med. Assoc.; 233: No. 13, 1393-1394(29 Sep 1975).

The public health aspects of the use of x-ray machines for airport security are discussed. Standards developed by the Bureau of Radiological Health for the safety of the machines are reviewed. (CH)

923 RESULTS OF CLINICO-PHYSIOLOGICAL OBSERVATIONS OF PERSONS EXPOSED TO OCCUPATIONAL IRRADIATION. Gus'kova, A. K.; Denisova, E. A.; Seltser, V. K.; Lvovskaya, E. N.; Kirsanova, G. I.; Gribova, I. A.; Gamper, V. V.; Katsnelson, G. M.; Loseva, N. V.; Stepanov, A. I. (Scientific-Research Inst. of Hygiene and Occupational Diseases, Moscow). Med. Radiol.; 20: No. 9, 36-46(Sep 1975). (In Russian).

The authors present results of many-year observations of persons handling sources of ionizing radiation, the irradiation doses for whom are close to the permissible level and their total sum is 10 to 100 bar. In the studied range of doses no marked clinical syndromes of the radiation sickness were revealed. With the

use of special techniques for the persons of the main group regularly in the range of doses over 20 bar there was observed a statistically significant increase of the number of deviations with widening of the scope of physiological shifts by the type of elevated lability of the neuro-vascular regulation with a formation in a number of cases of the syndrome of neuro-circulatory dystonia of the hypotonic type. This reaction was assessed as an adaptational one to the whole complex of the surrounding medium influences. Incidence of different somatic diseases and the structure of morbidity corresponded to that of the control group. All this makes it possible to consider the accepted permissible doses of external irradiation sufficiently substantiated by the criterion of direct reactions. (auth)

924 FUNCTIONAL CONDITION OF SYMPATHICO-ADRENAL SYSTEM IN OCCUPATIONAL IRRADIATION. Gorbarenko, N. I.; Denisova, E. A.; Pavlova, I. V. (Scientific-Research Inst. of Hygiene and Occupational Diseases, Moscow). Med. Radiol.; 20: No. 9, 46-52(Sep 1975). (In Russian).

The authors studied adrenaline and noradrenaline excretion in a daily quantity of urine in 65 persons (39 men and 26 women) at the age of 31 to 50 years, working in contact with irradiation. Functional insulin and adrenalin tests were made in 43 of them. Some increase of adrenalin and noradrenaline excretion was observed in personnel whose total irradiation dose exceeded 70 to 150 R. More noticeable shifts were noted when conducting functional tests which specifically influenced this system; this pointed to the disorders of the regulation mechanism of the sympathico-adrenal system. (auth)

925 CHANGES OF DESOXYRIBONUCLEOSIDES CONCENTRATION IN THE BLOOD PLASMA AND URINE. Solle, M.; ORBAN, U. (State Government on Atomic Security and Defense of Radiation, Berlin). Med. Radiol.; 20: No. 9, 53-55(Sep 1975). (In Russian).

Data are presented on the concentrations of different pyrimidine deoxyribosides in the plasma and urine of rats under normal conditions and after irradiation. The results are discussed with regard to the application of the different desoxyribonucleosides as indicators of radiation injury. Preliminary results from the determination of these metabolites in human plasma and urine are reported. The importance of deoxycytidine determination in the plasma for diagnosis of radiation injuries is discussed. (auth)

926 OCCUPATIONAL EXPOSURE TO X RADIATION IN POLAND: PROBABILITY OF EXCEEDING THE VITAL DOSE. Jankowski, J.; Liniecki, J.; Krych, B. (Z Zakladu Ochrony Radiologicznej Instytutu Medycyny Pracy, Lodz, Poland). Pol. Przegl. Radiol. Med. Nukl.; 39: No. 3, 387-394(1975). (In Polish).

On the basis of results of measurements of individual doses carried out by means of dosimetric films the probability of exceeding the vital dose by individuals exposed during their occupational work to x-rays was evaluated. The probability of exceeding the vital dose of exposure 200 R is practically nil, but the probability of exceeding of a dose ten times lower than the presently acceptable one (20 R) lies in the range from 0.7% to about 4%. (auth)

927 PROBLEMS OF A POSSIBLE CARCINOGENESIS BY INTRACAVITARY CONTACT IRRADIATION OF THE ENDOMETRIUM. Steinheider, K. Wuerzburg, Ger.; Wuerzburg Univ. (1973). 44p. (In German). INIS.

Thesis.

The results of 181 women who had a radium menolysis between 1958 and 1965 were investigated. The cases were evaluated according to indication, age distribution, histological findings, dose distribution, haemostasis effect, relapse rate and cause of death. Meanwhile, 13 of these patients have died, 3 of them of malignant tumours of the small pelvis which were possibly radiation-induced. Two of these cases correspond to the latency period given by most authors with an interval of 5 and 7 years between irradiation and death. This percentage is in the range which is determined by most of the authors for the number of the subsequent carcinomas under comparable conditions, and is quoted against an original connection between irradiation with ionizing radiation and later resulting malignant tumours of the female genitals. A particular tumour-inducing effect of irradiation assumed by some authors due to the regeneration of not completely destroyed cells is not to be seen in the results mainly obtained from the beta-radiation menolysis. (GE)

928 RADIATION DOSE TO THE SUPRACLAVICULAR CAVITY FOR DIFFERENT FIELD ADJUSTMENTS OF POST-IRRADIATED MASTECTOMIZED WOMEN. Mueller, E. J. Heidelberg; Heidelberg Univ. (1972). 48p. (In German). INIS.

Thesis.

By exact dose measurements in the supraclavicular fossa, the question of whether skin reactions occasionally found in the median region of the supraclavicular fossa and in the adjoining regions of the neck of mastectomized women treated by conventional radiotherapy using four steady state fields are due to excessive amounts of radiation or to a special property of the skin at this point was investigated. X-ray dose measurements were performed by means of capacitor chambers. The highest X-ray doses were measured in the middle of the supraclavicular fossa as a result of direct supraclavicular field irradiation. The strong exposure of the skin as a result of this field setting is unavoidable and cannot be the cause of the skin reactions in the median region because the other areas of the skin are exposed even more strongly. A major fraction of the exposure of the skin in the supraclavicular fossa is contributed by the axillary field irradiation in which a non-uniformity of the angles is to be observed in repeated settings of the irradiation field, which has major consequences upon the skin of the supraclavicular fossa. It can be shown by intentional systematic variation of the angle of exposure that the radiation will be distributed most uniformly throughout the supraclavicular fossa at angles between 30° and 40° and, hence, that the exposure of the skin accordingly will not be concentrated upon a specific point. (GE)

929 RADIATION-INDUCED CHANGES OF LUNGS FOLLOWING DEEP IRRADIATION OF INTRATHORACIC TUMORS. Koberg, G. D. Essen; Univ. Essen (1972). 60p. (In German). INIS.

Thesis.

Radiation pneumonitis is a serious complication in the radiation treatment of intrathoracic tumors with a characteristic course. A diagnosis of radiogenic changes in the lungs involves projection on the irradiation fields and the centre of dose distribution. Furthermore, the change must be detectable during the radiological course control 1 to 3 months after the radiotherapy has been discontinued. Irradiation records and radiographs of 351 patients were studied. All the patients had received the threshold focal dose for radiation pneumonitis—2,500 R. If radiation pneumonitis is regarded as a function of the patients age, one of four patients under 60 presents a serious radioreaction. With the patients over 65 and a sufficient period of observation, two of three patients become ill. Particular importance must, however, be attached to the fact that (as observations of over 6 months have shown) slight radiation pneumonitis can still be cured in 44% of the cases, and severe pulmonitis in 18.5% of all cases between the 4th and 10th month after irradiation if the therapy is applied early. (GE)

930 CHROMOSOME ANALYTICAL INVESTIGATIONS IN HUMAN LYMPHOCYTES FOLLOWING OCCUPATIONAL IRRADIATION. Al-Agha, I. Ulm, Ger.; Ulm Univ. (1974). 74p. (In German). INIS.

Thesis.

The relationship between the radiation dose received during occupational handling of ionizing radiations and the induction of chromosomal aberrations was studied. Chromosome analyses were performed in volunteers who are occupationally exposed to radium and/or X-rays or artificial radionuclides. A group of persons who are evidently not exposed to any radiation served for control. Handling ionizing radiation causes a significant increase of stable as well as unstable chromosomal aberrations which does not depend on the type of radiation. The significant increase of unstable chromosomal aberrations as compared with those in persons handling radium indicates that the chromosomal aberrations are increased following X-ray exposure. A dose-response relationship could not be demonstrated on the basis of film dosimeter supervision. The investigations showed that various types of chromosomal aberrations occurred to a greater extent in the peripheral lymphocytes after occupational radiation exposure. Yet they cannot be used quantitatively or qualitatively as a biological indicator of the radiation dose acquired. (GE)

931 INVESTIGATIONS OF THE BI-AXIAL AND TELE-CENTRIC ELECTRON PENDULUM IRRADIATION OF THE CERVIX CARCINOMA FOR AN EXCENTRIC POSITION OF THE PENDULUM AXIS USING THE 42 MeV BETATRON OF SIEMENS. Schmidt, N. Homburg/Saar, Ger.; Universitaet des Saarlandes (1972). 40p. (In German). INIS.

Thesis.

Systematic investigations of biaxial cineroentgenotherapy with fast electrons were carried out monoenergetically and bi-energetically with the body-simulating Alderson phantom with the aid of membrane segments. The pendulum radius was 120.0 cm and the pendulum axis field 4.5 × 23.4 cm. The pendulum axis had a depth of 10.5 cm and of 17.5 cm on the opposite side. The electrons had an energy of 42 MeV in the monoenergetic measurements and an alternating additional energy of 20, 15, and 9 MeV in the

bi-energetic measurements. Ten pendulum movements were carried out on each side—five movements with one energy on each side for the bi-energetic measurements. The pendulum angle was 25% for the first measurement and 20° for all other measurements. The isodose curves were recorded and discussed. (GE)

Vertebrates

Refer also to abstracts 841 and 873.

932 (AD/A-004597) TEMPORAL CHANGE IN RADIOSENSITIVITY OF MINIATURE SWINE AS EVALUATED BY THE SPLIT-DOSE TECHNIQUE. Taylor, J. F.; Terry, J. L.; Ekstrom, M. E.; West, J. E. (Armed Forces Radiobiology Research Inst., Bethesda, Md. (USA)). Jul 1974. 26p. (AFRRI-SR-74-14). NTIS $3.75.

Using the split-dose technique, recovery was measured in miniature swine exposed to whole-body ^{60}Co gamma radiation delivered at 34-35 rads/min. The initial conditioning dose (150 rads) was approximately two-thirds of the normal LD50/30 (237 rads). The redetermined or challenge LD50/30 measured 28 days after the conditioning dose was 477 rads, indicating 260 percent recovery from the initial sublethal dose. Histopathological examinations of three animals euthanatized 28 days after 150 rads revealed no histologic evidence that could account for the radioresistant state at that time. (GRA)

933 (AD/A-004854) CEREBRAL TEMPERATURE CHANGES IN THE MONKEY (MACACA MULATTA) AFTER 2500 RADS IONIZING RADIATION. McFarland, W. L.; Willis, J. A. (Armed Forces Radiobiology Research Inst., Bethesda, Md. (USA)). Apr 1974. 15p. (AFFRI-SR-74-7). NTIS $3.25.

To determine the temperature response of the brain to radiation, thermistor temperature sensing probes were implanted into thalamic and cortical areas of eight monkeys and the arch of the aorta. After securing base-line temperature recordings, the monkeys were exposed to 2500 rads whole-body pulsed mixed gamma-neutron radiation in the AFRRI-TRIGA reactor. Temperature at all measured sites generally dropped briefly immediately after the pulse, then rose and stayed elevated 1-2C for the remainder of the 3½-hour observation period. There did not appear to be any regional differences in brain temperature response, and brain temperature followed core (aortic) temperature changes. (GRA)

934 (AED-CONF-75-141-003) IN-VIVO DETERMINATION OF RBE FACTORS FOR 15 MeV NEUTRONS FOR VARIOUS BIOLOGICAL TERMINAL POINTS IN NORMAL TISSUE AND IN SARCOMA 180 (EXTERNAL MEASUREMENTS WITH IODODEOXYURIDINE). Porschen, W.; Feinendegen, L. E. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Medizin). 1975. 9p. (In German). INIS.

From 6th scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik; Berlin, F. R. Germany (28 Apr 1975).

The exact knowledge of the RBE factors in healthy as well as in tumor tissue is a precondition for an efficient radiotherapy. These factors were determined by external measurement of the incorporation rate of labelled iododeoxyuridine in the DNA of an experimental tumor or in the healthy tissue (bone marrow, gastrointestinal tract). A Dynagen (300 kV) type generator was used for the neutron irradiation which was equipped with a rotating tritium target (70 Ci). The neutron dosimetry was carried out with activation probes, with Si diodes and with the fission-track method. The measurement of the ^{125}I activity of the radioactive DNA precursor was either carried out with the whole-body counter for small animals or with a tumor measuring place which is designed in such a way that only the γ-rays of the ^{125}I from the tumor region are registered. NMRI mice were either irradiated with γ-rays or with 15 MeV neutrons. 2μCi of ^{125}I deoxyuridine were injected into a tail vein at different times. After 2 days, the total body retention of the ^{125}I was measured and compared with the non-treated controls. The incorporation rate was dependent on the time interval between irradiation and injection. Sarcoma 180, a solid experimental tumor, was transplanted to the right back thigh of NMRI mice. The tumor was locally irradiated with either gamma radiation or with fast neutrons. The RBE factors for the cell loss rate as well as the RBE factors for the decrease of the incorporation rate of the radioactive precursor were analyzed. (GE)

935 (COM-74-50282-04-15/SL) "MERCENARIA MERCENARIA" (MOLLUSCA: BIVALVIA): TEMPERATURE-TIME RELATIONSHIPS FOR SURVIVAL OF EMBRYOS AND LARVAE. Kennedy, V. S.; Roosenburg, W. H.; Castagna, M.; Mihursky, J. A. (Maryland Univ., Solomons (USA). Natural Resources Inst.). Oct 1974. 8p. (CONTRIB-565; VIMS-CONTRIB-552). Fish. Bull.; 72: No. 4, 1160-1166(Oct 1974).

To estimate the effects of entrainment of Mercenaria mercenaria embryos and larvae in the cooling-water systems of steam-electric power plants, we used a thermal gradient apparatus. Cleavage stages, trochophore larvae and straight-hinge veliger larvae were subjected to 11 different temperatures for eight different time periods. There was a direct relationship of mortality with temperature increase and, at higher temperatures, with increase in time exposure. As the clams aged, temperature tolerance increased, with cleavage stages most sensitive to higher temperature and straight-hinge larvae least sensitive. Multiple regression analyses of percentage mortality on temperature and time produced estimating equations that allow prediction of percentage mortality under different conditions of temperature and time exposure. Entrainment of M. mercenaria embryos and larvae in cooling systems of power plants should be a short as possible if mortality is to be held to a minimum. (GRA)

936 (CONF-751001-4) INTERSPECIES COMPARISON OF THE TISSUE DISTRIBUTION OF WR-2721, A RADIOPROTECTIVE DRUG. Washburn, L. C.; Rafter, J. J.; Hayes, R. L.; Yahas, J. M. (Oak Ridge Associated Universities, Inc., Tenn. (USA); Oak Ridge National Lab., Tenn. (USA)). 1975. 6p. Dep NTIS $4.00.

From 3rd annual meeting of the southeastern cancer research association; Atlanta, Georgia, USA (2 Oct 1975).

Pre-irradiation intravenous administration of the radioprotective drug S-2-[3-aminopropylamino]ethylphosphorothioic acid (WR-2721) has potential value in radiotherapy because it doubles the radiation resistance of normal mouse tissues while affording only minimal protection to tumors. Deficient deposition of WR-2721 in tumor tissue has recently been demonstrated and this is thought to be a major reason for the preferential protection of normal tissues by the drug. Data originally obtained in studies using the mouse and rat indicated that the tissue distribution of WR-2721 was possibly more closely related to dose per unit surface area than to dose per unit weight. To test this hypothesis an interspecies comparison of the tissue distribution of ^{35}S-labeled WR-2721 was carried out in normal mice, rats, rabbits, and dogs at 15 and 30 minutes after intravenous administration. Results suggest that the surface area and body weight exert equal effects on the tissue concentration of WR-2721. The results further suggest that lower absolute doses of WR-2721 in the human, possibly as low as 20 mg/kg, may provide a radioprotective effect equivalent to that produced from 100 mg/kg in the mouse, i.e., a 50 to 80 percent increase in radiation resistance (CH)

937 INFLUENCE EXERTED BY SOME ANTIOXIDANTS OF THE PHENOL SERIES ON THE DEVELOPMENT OF THE INTESTINAL FORM OF RADIATION SICKNESS IN MICE. Nesterenko, V. S.; Suminov, S. I.; Gurvich, Ya. A.; Styskin, E. L.; Kumok, S. T. (Akademiya Meditsinskikh Nauk SSSR, Obninsk. Inst. Meditsinskoj Radiologii; Filial Fiziko-Khimicheskogo Inst., Obninsk (USSR); Nauchno-Issledovatel'skij Inst. Rezinovykh i Latekznykh Izdelij, Moscow (USSR)). Farmakol. Toksikol.; 37: No. 4, 443-446(Jul 1974). (In Russian).

For English translation see the journal Russ. Pharmacol. Toxicol.

Non-pedigreed white mice, after single whole-body irradiation with 1000 R, were given 30 mg/kg of 2,6-di-tert-butyl-4-methylphenol (Ionol), 40 mg/kg of 2,6-di-tert-butyl-4-methoxy-methylphenol, or 5 mg/kg of 2-tert butyl-6-α-methylbenzyl-4-methylphenol. The first two substances hindered development of radiation damage in the small intestine but had no effect on damage to the hematopoietic system. 2-tert-Butyl-6-α-methylbenzyl-4-methylphenol, more than the other two compounds, hindered radiation damage to the blood system and showed no effect on damage to the intestine. Ionol and 2,6-di-tert-butyl-4-methoxymethylphenol doubled the average length of life of irradiated mice in the intestinal form of acute radiation sickness. (tr-auth)

938 BIORHYTHMS. II. Disturbance of Circadian Rhythms of Paramagnetic Centers of Concentration in Mouse Organs Due to Ionizing Radiation. Kovalenko, O. A.; Ivannikova, A. G.; Chibrikin, V. M.; Piruzyan, L. A. (AN SSSR, Moscow. Inst. Khimicheskoj Fiziki). Biofizika; 19: No. 4, 702-706(May 1974). (In Russian).

For English translation see the journal Biophysics.

The effect of x radiation on the circadian rhythms of concentration of paramagnetic centers in mouse organs was studied. In animals that survived 30 days after a 450-R dose, the nature of the variation in concentration of these centers in the liver and spleen differed from normal. (tr-auth)

939 EFFECTS OF LOW LEVEL RADIATIONS ON SOME ENZYMES AND NUCLEOPROTEIN METABOLISM IN GUINEA PIG BRAIN. Bhatavdekar, J. M.; Hinoy, N. J.; Shah, V. C.

(Gujarat Univ., Ahmedabad (India). Dept. of Zoology). Indian Biol.; 5(1): 51-56(Apr 1973).

35 refs., 2 tables.

Biochemical investigations were carried out on the effects of low level x irradiation on some enzymes, nucleic acids, and protein in the brain of control, treated, and recovering guinea pigs. The concentration of succinate dehydrogenase decreased upon radiation but after three days the activity was not only restored but was also enhanced nearly twofold of the normal value. The levels of RNA significantly decreased while those of phosphatases decreased only slightly by radiation and normal values were not restored even after three days of recovery. On the other hand, DNA and protein metabolisms recovered to almost normal values within 72 hours. The significance of the results with special reference to changes in brain metabolism is discussed. (auth)

940 STRESS AND REACTION OF THE HEMOPOIETIC ORGANS (CONCERNING THE ROLE OF PATHOLOGICAL PHYSIOLOGY IN THE DEVELOPMENT OF THEORETICAL MEDICINE). Review. Gorizontov, P. D. Patol. Fiziol. Eksp. Ter.; No. 2, 3-6(Mar 1974). (In Russian).

In order to characterize the role of pathological physiology in the development of general pathology and other areas of theoretical medicine the author refers to a study of the blood system under the action of a large number of irritants (stressors), including also the irradiation of animals. In experiments on the irradiation of rats from the data of Shcherbova and coworkers, to whom the author refers, it was established that an increase in the number of lymphoid cells in the bone marrow of an irradiated extremity (1000 R) could take place only by migration of the cells to the bone marrow from unirradiated parts of the animal. The migrating lymphoid cells apparently promote activation of myelopoiesis, that is, by differentiating into reticular cells, they become the initial source of myelo- or erythropoiesis, as indicated by the appearance of the transition cells. (INIS)

941 COMBINED ACTION OF ACETONE AND X RAYS. Kolesnikov, P. A.; Tiunov, L. A.; Zherbin, E. A.; Tajer, S. M.; Kolosova, T. S. Farmakol. Toksikol.; 37: No. 4, 446-450(Jul 1974). (In Russian).

For English translation see the journal Pharmacol. Toxicol.

In experiments on white mice it is shown that the inhalation effect of acetone simultaneously with x-ray irradiation leads to a higher animal mortality than with the separate action of these factors. This effect was followed over the range of acetone concentrations from 34 to 68 mg /1 and x-ray dose from 0 to 600 R. Formulas are presented for estimating mortality probabilities and the degree of increase in effect from the combined action of both factors. A discussion is presented of the mechanism of the synergistic effect from the combined action of acetone and x-ray irradiation. (tr-auth)

942 THYMIDINE AND DESOXYURIDINE EXCRETION IN IRRADIATED HAMSTERS FOLLOWING ADMINISTRATION OF EXOGENOUS DNA. Mikhajlov, V. T. (Institut Biofiziki, Moscow (USSR)). Byull. Eksp. Biol. Med.; 77: No. 6, 48-51(Jun 1974). (In Russian).

For English translation see the journal Bull. Exp. Biol. Med.

Hyperexcretion of thymidine and desoxyuridine in the urine of hamsters is shown during the first days after irradiation of doses of 600, 700, and 1000 R. On investigating the excretion dynamics of the nucleosides after irradiation (700 R) an increase in nucleoside content in urine was found on the 1, 8 to 10th, and 25th days. Administration of DNA to the hamsters 1 hour after irradiation (1000 R) led to a decrease in level of nucleosides on the 1st day. (tr-auth)

943 REACTION OF BONE MARROW CELLS IN MICE ON THE CHANGE OF PARAMETERS IN SUPERHIGHFREQUENCY IRRADIATION OF MILLIMETER RANGE. Sevast'yanova, L. A.; Vilenskaya, R. L. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Ehksperimental'noj i Klinicheskoj Onkologii). Biol Nauki; 6: No. 126, 48-50(1974). (In Russian).

In experiments on mice the optimum parameters were found for high-frequency, millimeter irradiation (values of power density, wave lengths, and irradiation time). At these values of the very high-frequency radiation there is a maximum decrease in the harmful action of x ray radiation on cells of the bone marrow. (tr-auth)

944 GLUCOCORTICOID ACTIVITY OF ADRENAL GLANDS AND OXIDATIVE PHOSPHORYLATION OF LIVER MITOCHONDRIA IN MONGOLIAN SANDMOUSE FOLLOWING IRRADIATION. Sukhanova, G. A.; Zhikhareva, A. I.; Kostesha, N. Ya.; Ryazanov, V. M.; Dokshina, G. A. (Tomskij Gosudarstvennyj Univ. (USSR)). Biol. Nauki; 6: No. 126, 44-47(1974). (In Russian).

It is shown that in sand mice the content of 11-oxycorticosteroids in the blood is higher than in rats. The addition of plants to the diet, which were collected at sites inhabited by radioresistant animals, increased the content of 11-oxycorticosteroids in the blood, and also the rate of oxidative phosphorylation of liver mitochondria in rats and sand mice. On irradiation, the intensity of oxidative phosphorylation of rat liver mitochrondria was decreased by 21 to 27%, while in sand mice there was hardly any change. The high content of 11-oxycorticosteroids and the stability of oxidative phosphorylation of liver mitochrondria in irradiated sand mice is probably one of the factors responsible for the general radioresistance of the sand mice, and it has an adaptive character. (tr-auth)

945 COMBINED SHF-FIELD AND GAMMA-IRRADIATION EFFECT ON THE BLOOD FORMATION. Tikhonchuk, V. S. Kosm. Issled.; 12: No. 3, 478-482(May 1974). (In Russian).

For English translation see the journal Cosmic Res.

With a preliminary irradiation of mice by a high-frequency field having a power density of 100 mwatts/cm^2 for 4 minutes each day over a period of one month (31 high-frequency irradiations) and subsequent gamma irradiation at a dose of 400 R (Co-60, 23 R/min) the radiation sickness reaction becomes worse. This effect of the biological interaction of electromagnetic waves and ionizing radiation on the hematopoietic system is believed to be a synergistic effect. (tr-auth)

946 INFLUENCE OF GENERAL IRRADIATION WITH X RAYS ON THE ACTIVITY OF MONOAMINE OXIDASE IN DIFFERENT PARTS OF THE BRAIN. Goksadze, G. K. Soobshch. Akad. Nauk Gruz. SSR; No. 3, 673-676(1973). (In Russian).

Studies have shown that the change in total monoamine oxidase (MAOase) activity of animal brain tissue after a single x irradiation exhibits a wave-like character in all of the cerebral areas examined. It was shown at the same time that the serotonin-specific MAOase is more sensitive to the radiation; moreover a different reaction of this enzyme is seen in the homogenate and in the mitochondria. (Ref. Zh.)

947 DISTURBANCES IN CARBOHYDRATE METABOLISM IN RADIATION SICKNESS AND ITS REPAIR UNDER THE EFFECT OF THERAPEUTIC PREPARATIONS. Dokshina, G. A.; Silaeva, T. Yu.; Yartsev, E. I.; Yakovlev, V. G. (Tomsk State Univ., USSR). Radiobiol. Radiother.; 16: No. 3, 311-318(1975). (In German).

The effect of taurine (200 mg/kg) in combination with insulin (0.2 IU/kg) on the repair of hormonal activity and of carbohydrate metabolism in an experimentally released radiation sickness was examined. White rats of both sexes weighing 180 to 200 g were irradiated with a gamma-unit GUM-Co-50 with 700 rad, that corresponds to $LD_{70/30}$. The preparations were simultaneously administered intraperitoneally every other day altogether eight times from the 5th day after irradiation. Survival rate in the groups of treated animals was by about 27% higher than in the control. With the administration of therapeutic preparations a repair of the insulin-like plasma activity to the normal levels and a considerably inhibition of liver phosphorylase activity could be observed. Different from insulin action alone a combined use of insulin and taurine led to a decrease in blood level of 11-oxycorticosteroids the metabolism of which being essentially impaired by irradiation to the normal value. The restoration of correlation between hormonal activity of adrenal cortex and of the insular apparatus favored glycogen reproduction in the liver and the decrease in blood-sugar level. Experiments with intact animals as well as in vitro experiments reveal that taurine acts insulin-like. (auth)

948 EXPERIMENTAL PRINCIPLES FOR THE USE OF HYPOXIA IN RADIATION THERAPY. Jaromenko, S. P.; Neumeister, K.; Vaison, A. A. (Akademie der Wissenschaften, Berlin). Radiobiol. Radiother.; 16: No. 3, 319-329(1975). (In German).

In the irradiation of mice in hypoxic gas-mixtures (10 to 5% O_2 and 90 to 95% N_2) the lethal effect and the lesion of normal tissues (bone-marrow and skin) decreased compared to the radiation effect with normal air-breathing. Tumor destruction by irradiation was not diminished, but on the contrary an increased regression and less frequency of recurrences was noticed. (auth)

949 FATE OF HETEROLOGOUS ANTIGEN (^{131}I-HSA) IN THE ORGANS OF CHICKENS EXPOSED TO TOTAL-BODY X IRRADIATION BEFORE A SECONDARY ANTIGENIC STIMULUS. Porhazka, Z.; Hampl, J.; Krejci, J. (Univ. School of Veterinary Medicine, Brno). Radiobiol. Radiother.; 16: No. 3, 331-338(1975).

A study was made on the effect of ionizing radiation on the rate of elimination of ^{131}I-labelled human serum albumin from the blood and on its organ deposition in chickens exposed to 1200 R (LD_{50}) at various intervals before secondary antigen injection. In unirradiated control chickens, the elimination of antigen after

its secondary injection followed the typical three-phase pattern, characterized by an early onset (at day 5) and a rapid progress of the third phase. The elimination curve from irradiated birds paralleled rather closely that from the controls during the first and second phases while the phase of immune elimination was hardly perceptible. No major differences were found between the individual irradiated groups. The irradiated birds also showed less formation of antibodies and antigen-antibody complexes and a lower antigen content of the organs than the unirradiated controls. From the results it appears that the specific antigen uptake from the blood of chickens during the first and second phases of elimination of a secondary dose of antigen is radioresistant, and the temporal relation between x irradiation and secondary antigen injection does not play a substantial role in impairment of the secondary antibody response to soluble antigens in chickens. (auth)

950 INHIBITION OF PROTEOLYTIC FERMENTS BY TAURINE IN RADIATION SICKNESS. Dokshina, G. A.; Klimova, A. D.; Yartsev, E. I.; Yakovlev, V. G. (Tomsk State Univ., USSR). Radiobiol. Radiother.; 16: No. 3, 339-345(1975). (In German).

The application of taurine potassium phosphate (TKPh) as radioprotective remedy resulted in a considerably influence on the activity of the proteolytic ferments in the irradiated organism. White male rats with a weight of 160 to 180 g being kept in cages without any food for 12 hours before this experiment were irradiated with a gamma unit GUM-Co-60 with a dose of 700 rad ($LD_{70/30}$). A 4% solution of the preparation was injected in an amount of 40 mg per rat 1, 3, 5, 7 days after irradiation. Under the effect of ionizing radiation there was a progredient increase of proteolytic ferment activity of liver and spleen which was detected already 30 min after irradiation with maximum rate of proteolysis on the 21st day. After injection of the preparation a two-phase reaction developed: on the 7th to 12th day an increased activity of cathepsins in the tissue and in the following time up to the 30th day of observation an inhibition of ferment activity was demonstrated. Simultaneously it was found that the radiation-induced corticosteroid level was prevented by the preparation. A similar effect was also shown by TKPh inhibiting proteolytic ferment activity in experiments with rats with preceding application of hydrocortisone in high doses. The obtained results permit the assumption that the radioprotective activity of taurine comes about by its effect in the direction of structural integrity of the cell membranes leading to a normalization of the hormonal and fermentative events. (auth)

951 HEMATOLOGICAL CHANGES AND SURVIVAL OF MICE FOLLOWING CONTINUOUS IRRADIATION. Kalina, I.; Praslicka, M.; Marko, L.; Hudak, S. (Univ., Kosice, Czech.). Radiobiol. Radiother.; 16: No. 3, 347-354(1975). (In German).

In experiments the effect of continuous irradiation on stem-cells of hematopoiesis, elements of the peripheral blood and on the survival of mice was followed. All values examined could be found to decrease with 100 to 1000 R per day. The decrease is most rapid and highest in CFU, thrombocytes, and granulocytes, then in bone-marrow cellularity, granulocytes, and erythrocytes. The respective survival of the animals was determined in the range of 50 to 1000 R per day. The equation for the survival curve was elaborated showing a hyperbolic shape. (auth)

952 ULTRASTRUCTURE OF GLIAL CELLS IRRADIATED IN VITRO WITH GAMMA RAYS (^{60}Co). Ostenda, M. Neuropatol. Pol.; 11: No. 4, 405-410(1973). (In Polish).

The cultures of glial cells were irradiated with a one-time dose of 5000 R of gamma rays and thereafter were taken for electron microscopic examinations in the period of 3 to 72 hours after exposition. In the early periods after exposition (3 to 6 hrs), the Golgi apparatus showed an enhanced activity. In the cytoplasm, glycogen appears and the features of pinocytosis disappear. The symptoms retreat after 24 hrs. A parallel appearance of glycogen and reduction of pinocytosis are indicative of a transient impairment of the cellular metabolism. The increase in the later periods (72 hrs) of the number of secondary lysosomes, autophagosomes, and lipofuscine suggests the irreversibility of this impairment. The accumulation of glycogen in the impaired astrocytes in vitro indicates that this feature is independent upon their nutritional and transporting functions. (auth)

953 ISOGENEIC OR ALLOGENEIC TRANSPLANTATION OF DUCT-LIGATED PANCREAS IN STREPTOZOTOCIN DIABETIC MICE. Kramp, R. C.; Congdon, C. C.; Smith, L. H. (Oak Ridge National Lab., TN). Eur. J. Clin. Invest.; 5: 249-258(1975).

Recovery from hyperglycaemia was observed in three different mouse hybrids that were made diabetic with streptozotocin, and then transplanted with pancreas from isogeneic donors whose pancreatic ducts were ligated over 8 weeks earlier. Recovery did not occur in recipients of allografts indicating that islets in ligated pancreas cannot be successfully transplanted across a major histocompatibility barrier. However, in lethally irradiated mice injected with allogeneic bone marrow (allogeneic radiation chimeras), subsequent transplantation of ligated pancreas from either isogeneic donors or allogeneic donors of the same strain as the bone marrow donor decreased blood glucose of diabetic recipients. Thus, irradiation and allogeneic bone marrow therapy allow subsequent allogeneic transplantation of functional islet tissue in diabetic mice. Observations on diabetic mice transplanted isogeneically with ligated pancreas suggest that recovery from hyperglycaemia was more consistent when grafts were placed subcutaneously rather than intraperitoneally and when hosts received ligated pancreas from three donors rather than one. Thus, the site and amount of tissue transplanted are important considerations in the transplantation of ligated pancreas. Persistence of endocrine β-cells in ligated pancreas was required for recovery in grafted mice since diabetic hosts failed to recover when grafted with ligated pancreas obtained from alloxan or streptozotocin-treated, diabetic donors. (auth)

954 STUDIES ON RADIOPROTECTIVE PROPERTIES OF PRODIGIOSINE IN ROENTGEN AND NEUTRON IRRADIATION. Monastyrskay, B. I.; Lavrova, G. A.; Sverdlov, A. G., Weisberg, G. E.; Ermolieva, Z. V. (Leningrad Inst. of Nuclear Physics). Antibiotiki; 19: No. 12, 1108-1112(Dec 1974). (In Russian).

The radioprotective properties of prodigiosine were studied after roentgen and neutron irradiation of 1500 inbred albino mice. The animals were irradiated with the help of apparatus RUM-II in doses of 600 to 700 R and in the field of γ-neutrons of the vertical biochannel of reactor VVR-M in doses of 232 and 261 rad. The animal survival, weight, and morphological analysis of the changes in the spleen and thymus were used as the tests for determination of the radioprotective properties of prodigiosine. It was shown that prophylactic administration of prodigiosine 24 hours before the irradiation had a pronounced protective effect when the irradiation dose was $LD_{90/30}$. After the roentgen and neutron irradiation the animal death rate decreased 45 and 22 per cent respectively. The protective effect of prodigiosine after the roentgen irradiation was observed during both the intestine and the bone marrow syndromes while after the neutron irradiation it was registered during the intestine syndrome. The studies showed that prodigiosine had a stimulating effect on the reparative processes in the blood forming tissue. (auth)

955 STEEPNESS OF THE DOSE-RESPONSE CURVE IN RADIATION THERAPY. Fischer, J. J.; Moulder, J. E. (Yale Univ., New Haven). Radiology; 117: No. 1, 179-184(Oct 1975).

The random nature of cell killing by ionizing radiations sets an upper limit on the steepness of the dose–response (D–R) curve for tumor cure. This theoretical limit was approached but not reached in a carefully controlled experimental system using experimental rat rhabdomyosarcomas. It would seem unlikely that this result could be achieved in clinical practice because of the potential importance of tumor heterogeneity and treatment error in decreasing the slope of the D–R curve. In attempting to achieve a high degree of precision in treatment administration, the therapist, particularly in a multitreatment course, is aided by certain statistical rules which are applicable to random errors. (auth)

956 ACUTE AND LATE EFFECTS OF 16- AND 50-MeV/sub d yields Be/ NEUTRONS ON THE ORAL MUCOSA OF RHESUS MONKEYS. Jardine, J. H.; Hussey, D. H.; Boyd, D. D.; Raulston, G. L.; Davidson, T. J. (Univ. of Texas, Houston). Radiology; 117: No. 1, 185-190(Oct 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Twenty-five rhesus monkeys were randomly assigned to one of five mouth irradiation treatment schedules: control group, no irradiation; ^{60}Co gamma five times weekly; ^{60}Co twice weekly; 16-MeV/sub d yields Be/ neutrons twice weekly. Although the acute reactions of the oral mucosa were similar in the four irradiated groups, the late sequelae were more severe in the animals irradiated twice weekly with ^{60}Co gamma or neutrons. All of the animals irradiated with ^{60}Co gamma twice weekly or with 16 MeV/sub d yields Be/ neutrons exhibited oromucosal necrosis, whereas none of those irradiated five times weekly with ^{60}Co gamma did. The difference in the effect of photon fractionation on early and late radiation sequelae may be related to different patterns of redistribution of surviving cells through the division cycle in tissues responsible for early and late damage. (auth)

957 TIME/DOSE RELATIONSHIPS IN EXPERIMENTAL RADIATION CATARACTOGENESIS. Schenken, L. L.; Hagemann, R. F. (Allegheny General Hospital, Pittsburgh). Radiology; 117: No. 1, 193-198(Oct 1975).

The response of the mammalian lens to fractionated radiation

exposures was evaluated as a model system for predicting delayed radiation effects on normal tissue. Only the heads of male Ha/ICR mice were x irradiated with 14 different time-dose schedules and followed for cataractous changes. A log-log plot of dose vs time yielded a line with a slope of 0.303 and ordinate intercept of 1050 R; a similar plot for dose vs fraction number yielded a slope of 0.382 and ordinate intercept of 835 R. Results suggest that the lenticular response to radiation may be a useful model for studying late effects. (auth)

958 RADIOPROTECTIVE EFFECTS OF VASOPRESSIN ON THE GASTROINTESTINAL TRACT OF MICE. Rappleye, A. T.; Johnson, G. H.; Olsen, J. D.; Lagasse, L. D. (Univ. of Utah, Salt Lake City). Radiology; 117: No. 1, 199-203(Oct 1975).

Three-hundred Balb/C mice were used to assess the effect of vasopressin on the response of the gastrointestinal tract to irradiation. Median lethal doses were determined for control and vasopressin-treated animals in which the whole abdomen was irradiated. There was a significant difference in LD/sub 50/ (882 +- 27 for controls vs. 1051 +- 23 for vasopressin-treated animals). In addition studies demonstrated a significant difference in the survival rate of jejunal crypts at 800 and 1,000 rads. (auth)

959 ASSESSMENT OF RBE OF CALIFORNIUM-252 FOR C57-BLACK/6 MOUSE FIBROSARCOMA BY A PRECISE AFTER-LOADING TECHNIQUE. Moser, F. L.; Lanzl, L. H.; Mewissen, D. J.; Furedi, E. M.; Rozenfeld, M. (Univ. of Chicago). Radiology; 117: No. 1, 205-209(Oct 1975).

Afterloading techniques were developed for the in vivo assessment of the RBE of californium-252 neutrons with respect to radium-226 gamma using a fibrosarcoma in mice. The afterloading holder positions sources so that the tumor is uniformly irradiated. Using the end points of tumor volumetric studies up to 150 days after irradiation, it was found that the RBE ranged from 5 to 8 at clinically relevant dose rates and total doses. (auth)

960 RELATIONSHIP BETWEEN THE TIME OF FRACTIONATED AND SINGLE DOSES OF RADIATION AND HYPERTHERMIA ON THE SENSITIZATION OF AN IN VIVO MOUSE TUMOR. Alfieri, A. A.; Hahn, E. W.; Kim, J. H. (Memorial Sloan-Kettering Cancer Center, New York). Cancer; 36: No. 3, 893-903(Sep 1975).

The present study was undertaken to explore the relationship of the time interval between application of heat and irradiation on enhanced tumor cell sensitivity. Using the Ridgway osteogenic sarcoma grown in AKD_2F_1/J mice, local tumor hyperthermia (42.5 +- .5°C for 15 minutes) was applied at various time intervals before or after single or fractionated doses of x irradiation. Enhancement of tumor cell sensitivity by combined treatment with radiation and heat, as measured by delay in tumor growth, cure rates, and mean survival times was inversely proportional to the time interval between application of both modalities. The interactions associated with this increased sensitivity appear to be transitory, diminishing with time between treatments. Possible mechanisms of action for thermal sensitization may involve the reduction of oxygen dependence as well as a reduced recovery capacity of tumor cells. (auth)

961 INFLUENCE OF EXTERNAL β-IRRADIATION ON MORPHOLOGICAL STRUCTURES OF THE SKIN. Samsonova, T. V. Med. Radiol.; 20: No. 9, 55-59(Sep 1975). (In Russian).

In the experiment made on mice the author studied morphological dynamics of acute radiation injury of the skin which had been caused by external β-irradiation in a dose of 6000 rad. The importance of vascular changes was shown in the development of acute radiation ulcer of the skin. Artery spasms which develop soon after irradiation, artery and vein affection which develop a little later and have the course of endo- and pan-vasculites type, promote the development of acute necrotic processes of the skin and inhibit reparation. The level of biogenic amines, histamine (the number of mast cells in the derma being its index) is important for inducing radiation injury of the skin. (auth)

962 ANTINEOPLASTIC EFFECT OF IODINE-125-LABELLED IODODEOXYURIDINE. Bloomer, W. D.; Adelstein, S. J. (Harvard Medical School, Boston). Int. J. Radiat. Biol.; 27: No. 5, 509-511(May 1975).

It has been suggested that ^{125}IUdR might be effective in the treatment of certain malignant neoplasmas. The results of a pilot study using therapeutic doses of ^{125}IUdR in an experimental murine tumor are reported. The prolonged survival of tumour-bearing animals treated with ^{125}IUdR provides a promising new approach to tumor therapy and merits further investigation. (UK)

963 BIOLOGICAL PROPERTIES AND RESPONSE TO X RAYS OF FIRST-GENERATION TRANSPLANTS OF SPONTANEOUS MAMMARY CARCINOMAS IN C3H MICE. Fowler, J. F.; Sheldon, P. W.; Begg, A. C.; Hill, S. A.; Smith, A. M. (Mount Vernon Hospital, Northwood, Eng.). Int. J. Radiat. Biol.; 27: No. 5, 463-480(May 1975).

First-generation transplants of spontaneous mouse mammary carcinomas have been used extensively for radiobiological investigations of fractionated irradiation schedules, RBE of fast neutrons and effectiveness of radiosensitizers, as reported elsewhere. The present work investigates the growth characteristics of the tumors; the criteria for the choice of endpoints used in the definition of local control of irradiated tumors; the reason for a decrease of 30% in x-ray dose required to control tumors in female as compared with male mice; the proportion of hypoxic cells and its variation with time (reoxygenation) after a single dose of 1500 rad of x rays; and the repair capacity of tumor cells within 24 hours after a substantial first dose of x rays. Evidence is presented that the male-female difference was due to a higher proportion of hypoxic cells in tumors in male than in female mice. The repair of sub-lethal injury in tumor cells made hypoxic was slightly less than in skin made hypoxic but not significantly so. In the two-dose experiments on clamped tumors, no evidence of induced synchrony was found. (auth)

964 SOME ASPECTS OF BRAIN NEUROCHEMISTRY AFTER INTRAUTERINE EXPOSURE TO TRITIUM. Bursian, S. J.; Cahill, D. F.; Laskey, J. W. Int. J. Radiat. Biol.; 27: No. 5, 455-461(May 1975).

Rats were continuously exposed to tritiated water (0, 1, 10, and 100 μCi HTO/ml body water) from conception to birth. Calculated, cumulative whole-body doses to the embryo and foetus were approximately 0, 6.6, 66 and 660 rad. The levels of several enzymes and established or presumptive central nervous system neurotransmitters were examined postnatally in whole brains. These were norepinephrine (NE, dopamine (DA), acetylcholinesterase, (AChE) and monoamine oxidase (MAO). Intrauterine exposures to doses as low as 66 rad produced measurable and persistent decreases in brain weight and increases in NE concentrations at 21 and 45 days postnatally. No differences from control values were seen in the rate of turnover of NE or the concentrations of DA, AChE, or MAO at 45 days. Exposure in utero to 6.6 rad produced no detectable postnatal effects on the brain neurochemical parameters measured. (auth)

965 DIFFERENTIAL REGENERATION OF INTESTINAL PROLIFERATIVE CELLS AND CRYPTOGENIC CELLS AFTER IRRADIATION. Potten, C. S.; Hendry, J. H. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Int. J. Radiat. Biol.; 27: No. 5, 413-424(May 1975).

A dose of 900 rad γ rays to mice reduces the number of cryptogenic cells (those capable of crypt regeneration) per small intestinal crypt from about 80 to about 2 per surviving crypt. The surviving cells repopulate the crypt, the estimated cell-number doubling-time being about 24 hours, and on the fourth day after irradiation their numbers are still slightly below normal. The regeneration patterns for cryptogenic and proliferative cells differ significantly over the first 4 days after irradiation. The numbers of proliferative cells fall initially and remain low while the cryptogenic cells are increasing in number. The low levels persist for the first 1.5-2 days, after which there is a rapid rise in proliferative cells per crypt with a significant overshoot on the third day and a peak on the fourth day. The number of proliferative cells per crypt in control animals is about twice the number of cryptogenic cells. This ratio averages 12 after irradiation (days 1 to 4). These data add support to the hypothesis that small intestinal crypts contain a sub-population of stem cells that are distinct from the proliferative cells. (auth)

966 MEASUREMENT OF NUCLEUS SIZE IN PREIRRADIATED AND SECONDARY DAMAGED RAT LIVER. Hannes, W. Freiburg i. B., Ger.; Univ. Freiburg i. B. (1974). 54p. (In German). INIS.

Thesis.

Male white rats were subjected to four different kinds of treatment: irradiation and galactosamine; only galactosamine; only irradiation; no treatment (controls). After killing the animals, histological preparations were taken from the removed livers. It was shown that even at low radiation doses, a pre-irradiated rat liver behaves completely differently from a liver without prior exposure to radiation with regard to secondary lesions (galactosamine). The histopathological effects of each of the two noxae are described along with their combined effects, and an interpretation is attempted. (GE)

967 COMPARATIVE INVESTIGATIONS OF THE EFFICIENCY OF PREVENTIVELY AND THERAPEUTICALLY ADMINISTERED RADIOPROTECTIVE SUBSTANCES AGAINST ^{60}Co-GAMMA RAYS IN ALBINO MICE. Stroband, R. Muenster, Ger.; Univ. Muenster (1974). 104p. (In German). INIS.

Thesis.

The biological radiation protection effect of 10% novalgine[R] and aqua bidest. for ^{60}Co-gamma radiation (200–800 rad) was tested on white SW 50 mice of both sexes. In agreement with previous investigations, a radiation protection efficiency could be detected for both test substances. The extent of the radioprotective effect, besides the radiation exposure, is largely dependent on the time of application. An optimum effect could be achieved for both substances with intraperitoneal injection one hour before the radiation attack (dose reduction factors: novalgine[R]: 2.2; aqua bidest.: 2.0). These observations agree well with the pharmaco-dynamic characteristic effect of novalgine[R], having effective maximum between 60 and 120 min and thus coincides to a great extent with the time of the primary and secondary radiation injuries. The application two hours prior to radiation shows a weaker effect (dose reduction factors: novalgine[R]: 1.02, aqua bidest.: 1.00). With high radiation exposure (800 rad), there is a greater survival rate on the 30th day: novalgine 2%; aqua bidest. 4% and control 39%. This effect is explained as addition of metabolic disturbances due to radiation and iatrogenic metabolic load due to novalgine[R]. (GE)

968 RADIOSENSITIVITY OF THE DS-CARCINOSARCOMA OF THE RAT AS INFLUENCED BY IMMUNE REACTIONS. Rotte, K. Wuerzburg, Ger.; Univ. Wuerzburg (1972). 66p. (In German). INIS.

Thesis.

BDII rats obtained humoral antibodies in a xenogenetic or syngenetic immune serum or specific sensitized isogenetic immune cells for passive immunization. Other animals were actively immunized with a so-called large dose of DS-carcinosarcoma extract or a so-called small dose of the tumor extract. The mode of irradiation was chosen in such a manner that even slight differences in the radiation sensitivity between immunized and non-immunized animals would as far as possible not be hidden by other factors. Thus when irradiating the tumors, one did without the administration of a dose which would have affected a best possible irradiation effect. A greater fractionation of the uniformly administered total dose of 2,000 R in the tests was also avoided. If the growth of a tumor can be inhibited by an immunologic influence of the tumor host relationship, then the radiation sensitivity of these cells is simultaneously increased. If the specifically prepared immunity against tumors was not transferred to the test animals, no influence on the radiation sensitivity of the tumors was found. If the growth of the tumor accelerates, then a reduced radiation sensitivity of these tumors was simulated by the fast growth partly compensating the irradiation effect. A transfer of animal experimental investigations to the treatment of human cancer is still faced by great difficulties. The experience gathered in the last decades in the field of experimental tumor immunology are, however, important steps to this target. (GE)

969 RADIOSENSITIVITY IN DEPENDENCE ON THE CELL CYCLE. In-vivo Investigations of the Transplanted Sarcoma 180 Using ^{125}I-Deoxyuridine and 15 MeV Neutrons. Pittner, W. Juelich, Ger.; Kernforschungsanlage Juelich GmbH (1972). 55p. (In German). INIS.

Thesis.

The changes in the cell loss rate after irradiation with fast neutrons (15 MeV) were studied in the transplanted Crocker sarcoma (sarcoma 180) of male white mice of the NMRI strain by means of pulse labelling and external activity measurement. Observation of a partly synchronous cell population was made possible by selective incorporation of the thymidine-analogous ^{125}IDU in the DNA of the cells during the synthetic phase. Four parallel experiments all showed a markedly increased cell loss rate following irradiation at 10 to 13.5 hours after pulse labelling as compared to irradiation after 7 and 21 hours. The growth fraction was determined from the volume growth rate of the sarcoma 180 which was also used (together with the cell cycle time of this tumor) to calculate the relative composition of the cell population at every stage of irradiation. The measured cell loss rates confirm the assumption that the cells of the solid sarcoma 180 are significantly more radiosensitive in the synthetic phase than in the G_1 and G_2 phases. The radiosensitivity of the mitotic phase cannot be assessed. The results of the investigations are compared with identical and contrary results of other studies. (GE)

970 IRRADIATION OF THE CILIARY BODY WITH FAST ELECTRONS IN ANIMAL EXPERIMENTS. Brummund, J. Erlangen, Ger.; Univ. Erlangen-Nuernberg (1973). 43p. (In German). INIS.

Thesis.

The ciliary body of rabbits was fractionated and was given a single treatment with various doses of electron radiation produced by a betatron. The objective was to achieve a decrease of the aqueous humour production or of the i.o. pressure with regard to application in glaucomae. The method used is described, and it is shown that the monoenergetic, directed electrons of an accelerator are better than the nonuniform energy beta-radiation from radionuclides. The most important results of the investigation proved to be the influence on aqueous humour production of irradiation with statistically safe reduction of the i.o. pressure, the slight histological changes in the irradiated eyes, as well as the fact that damage or clouding of the lense was never observed. The method applied did not come up to all expectations. Further tests must be made in order to achieve more definite results. (GE)

Invertebrates

Refer also to abstract 865.

971 LABORATORY STUDIES ON RADIATION STERILIZATION OF THE RED PALM WEEVIL (RHYNEHOPHORUS FERRUGINEUS OLIV.) MALES. Rahalkar, G. W.; Harwalkar, M. R.; Rananabare, H. D.; Shantaram, K.; Gopal Ayengar, A. R. (Bhabha Atomic Research Centre, Bombay (India). Biology and Agriculture Div.). pp 141-146 of Proceedings of the First National Symposium on Plantation Crops, Trivandrum, December 8-9, 1972. Nayar, N. M. (ed.). (Central Plantation Crops Research Inst. Regional Station, Vittal (India)). Kasargod; Indian Society for Plantation Crops (1974).

From 1st national symposium on plantation crops; Trivandrum, India (8 Dec 1972). 4 tables, 3 graphs, 20 refs.

The effectiveness of radiation for the sterilization of Rhynchophorus ferrugineus Oliv., a pest of coconut and other palms, was investigated. X-irradiation of 1-2 day old males with a dose of 1.5 kr induced about 90% sterility without affecting survival. Higher dosages, however, significantly reduced male survival, though near complete sterility was obtained. Some of the sperms present at the time of irradiation were less radiosensitive and contributed towards egg viability during the initial period of oviposition. This egg viability was considerably reduced when the males were not provided with mates for 20 days. Similar results were obtained by flushing out the less susceptible sperm from the irradiated males through their successive matings with six females. Alternate matings with normal and irradiated (1.5kr) males revealed predominant utilization of sperm incorporated during recent matings. For appreciable suppression of progeny production, 10 irradiated males were required to compete with a normal one. (INIS)

972 EFFECTS OF GAMMA RADIATION ON TRYPANOSOMA CRUZI. Salati, E.; Correa, F. M. A. (Faculdade de Ciencias Medicas e Biologicas de Botucatu (Brazil)); Wiendl, F. M. (Sao Paulo Univ., Piracicaba (Brazil). Escola Superior de Agricultura Luiz de Queiroz. Dep. Entomologia). Rev. Inst. Med. Trop. Sao Paulo; 15: No. 2, 66-71(Mar 1973). (In Portuguese).

The effects of different dosages of gamma radiation upon the morphology, motility, reproductivity, virulence and protective capacity of culture forms of trypanosoma cruzi, Y strain, kept in Warren medium and inoculated into mice were studied. Alterations of morphology and motility of the parasites were not detectable even with doses of 90 Krad. The reproductivity was partially abolished with dosages of 30 or more Krad. When submitted to dosages 60 Krad, culture forms of Y strain of Trypanosoma cruzi diminished their virulence and when the dosage was 90 Krad it was abolished. Trypanosomes irradiated with 90 Krad and inoculated into mice did not afford any protection when the mice were submitted to a challenge inoculation with non irradiated virulent blood forms.

973 EFFECT OF ULTRAVIOLET IRRADIATION ON THE VIABILITY OF SPORES OF PLISTOPHORA SCHUBERGI AND NOSEMA AGROTIDIS. Nilova, G. N.; Strelnikova, L. V. Parazitologiya; 8: No. 5, 463-468(1974). (In Russian)

Study of the effect of various doses of ultraviolet rays on the suspension of spores of P. schubergi and N. agrotidis was carried out by means of luminiscent microscopy and biological test (the ability of spores to infect caterpillars of the turnip moth). The complete death of spores was observed in no case but the increasing dose of ultraviolet irradiation caused the reduction in the lethal ability of spores. Spores of P. schubergi proved to be less resistant to ultraviolet irradiation than those of N. agrotidis. (auth)

Radionuclide Effects (Internal Source)

Man

Refer also to abstracts 896, 899, and 1408.

974 (GSF-S-226) PROBLEMS CONCERNING THE RECOMMENDATION OF A MAXIMUM PERMISSIBLE INHALATION INTAKE OF SHORT-LIVED RADON-DAUGHTERS. Jacobi, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany)). [nd]. 12p. INIS.

The applicability of the risk concept for the evaluation of a maximum permissible annual exposure (MPAE) to short-lived ^{222}Rn-daughters in air is discussed on the basis of available data about lung cancer mortality among uranium miners. By comparison with other occupational risks and the background level of these nuclides in normal air a MPAE in the range of 2.5-5 WLM is derived which corresponds to a Rn-activity concentration of 20-40 pCi/liter in radioactive equilibrium with its daughters. Finally the relation between exposure and lung dose is discussed with respect to the importance of uncombined daughter atoms and the influence of ventilation. (auth)

975 (INIS-mf-1236, pp 44-52) SELECTED PROBLEMS OF INDIVIDUAL MONITORING FOR INTERNAL CONTAMINATION. Cwik, Y. (Inst. of Nuclear Research, Warsaw). 1972.

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In radioactive pollution of environment. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)).

Some problems involved in individual monitoring for internal contamination are discussed. The parameters, which can have influence for the results of monitoring and have to be taken into account, when interpreting the result, are surveyed. The difficulties in assessing dose commitments are briefly mentioned. (INIS)

976 (INIS-mf-1236, pp 53-72) PROBLEM RELATED TO THE ESTIMATION OF OCCUPATIONAL RADIATION EXPOSURE FROM INTERNAL CONTAMINATION. Rehak, W. (Staatliche Zentrale fuer Strahlenschutz, Berlin). 1972. (In German).

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In radioactive pollution of environment. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)).

After discussion of general principles of monitoring for internal contamination due to occupational exposure an attempt is made to evaluate the risk of incorporation considering such factors as activity, amount, duration and frequency of handling radioisotopes and maximum permissible yearly intake. With regard to monitoring programs human body counting and analysis of excreta are compared and the Investigation Level, as defined by the ICRP, is discussed. (auth)

977 (INIS-mf-1236, pp 122-137) POSSIBLE RADIATION BURDEN ASSOCIATED WITH THE RELEASE OF RADIOACTIVE MATERIALS FROM NUCLEAR PLANTS INTO THE ATMOSPHERE. Zindler, H. (Staatliche Zentrale fuer Strahlenschutz, Berlin). 1972. (In German).

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In radioactive pollution of environment. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)).

On the basis of a mean atmospheric dispersion factor and a supposed diurnal release of 3500 Ci of noble gases and 0.1 Ci of iodine by stack dispersion the maximum possible radiation burden to be expected at a distance 1000m downwind is estimated. In areas with high population density or in the case of release of long-lived gaseous fission products the exposure of the whole population must be taken into account in addition to the exposure of individual members of the public. International regulations governing the maximum permissible release of 85 Kr into the atmosphere seems to be necessary. (INIS)

978 (INIS-mf-1236, pp 217-227) DIETARY INTAKE AND URINARY EXCRETION OF CESIUM-137 AND STABLE CESIUM IN CHILDREN. Pietrzak-Flis, Z.; Bysiek, M. (Centralne Lab. Ochrony Radiologicznej, Warsaw). 1972. (In Polish).

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In radioactive pollution of environment. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)).

The content of ^{137}Cs and stable cesium was determined in diet, urine, and feces in 6-7 year-old children from Warsaw. The samples were collected in the period from January to December 1967. The average content of ^{137}Cs in diet was 26.3 ± 4.4pCi/day, and that of stable cesium was 3.1 ± 0.6 μg/day. The level of ^{137}Cs and stable cesium in the body of children, calculated from excretion, was 1.32 nCi and 0.14 mg, respectively. (INIS)

979 (SSI-1974-027) SOME MEASUREMENTS ON ^{210}Pb IN NONURANIUM MINERS IN SWEDEN. Snihs, J. O.; Schnell, P. O.; Suomela, J. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Sep 1974. 13p. (CONF-740935-3). Dep. NTIS (US Sales Only) $4.00.

From international symposium on radiation protection in mining and milling of uranium and thorium; Bordeaux, France (9 Sep 1974).

In many Swedish metal mines there was a considerable radon daughter exposure up to the 1970s. In order to compare the calculated accumulated exposure with the body burden, if any, of ^{210}Pb, a technique was developed for the measurement of ^{210}Pb in the skull by external counting using a thin NaI crystal. The technique is described. Measurements were made on ten miners with different exposure histories, the maximum of the order of 700 WLM, and a control group. The content of ^{210}Pb in blood and urine was measured. When ^{210}Pb was found, the levels have been very low. The results are compared with the estimated exposures and discussed against the background of the results presented by other authors. (auth)

980 THOROTRAST INJURIES OF MESOPHARYNX. Brandt, R. H.; Theuring, F. (Medizinische Akademie, Magdeburg (German Democratic Republic)); Luebcke, P. F. (Rostock Univ. (German Democratic Republic)). Radiol. Diagn.: 15: No. 1, 3-8(1974). (In German).

Following a short representation of the essential pathophysiological consequences of thorium incorporation two cases of iatrogenic thorotrastomas are demonstrated and discussed. The causal carotidangiography with thorotrast was made 38 and 28 years ago, respectively. (INIS)

981 DOSIMETRY OF DIRECT INTRALYMPHATIC ADMINISTRATION OF RADIOGOLD FOR GYNECOLOGICAL PURPOSES. Vebersik, V.; Dvorak, O. (Karlova Universita, Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi). Cas. Lek. Cesk.; 113: No. 35, 1059-1063(30 Aug 1974). (In Czech).

The knowledge is presented of the direct intralymphatic postoperative administration of ^{198}Au in the therapy of carcinoma of the vulvae. The ^{198}Au distribution in the organism was investigated as related to the method of work, the speed of application, and the concentration of the colloid. (INIS)

982 INTERNAL HEPATIC RADIOTHERAPY. II. Intra-arterial Radiocolloid Therapy for Hepatic Tumors. Grady, E. D.; Nolan, T. R.; Crumbley, A. J.; LaRose, J. H.; Cheek, W. V. (Georgia Inst. of Tech., Atlanta). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 124: No. 4, 600-609(Aug 1975).

From 75th annual meeting of the American Roentgen Ray Society; San Francisco (24 Sep 1974).

Many patients who undergo operation for colo-rectal carcinoma have overt liver metastases and treatment by means of intra-arterial radioisotope therapy in an attempt to eliminate clinical metastases was investigated. The efficacy of internal hepatic radionuclide therapy using ^{32}P-radiocolloids with respect to reducing hepatic metastases gave good results when tested in rats. (CH)

983 INTERSTITIAL THERAPY USING NON-ABSORBABLE (^{192}Ir NYLON RIBBON) AND ABSORBABLE (^{125}I "VICRYL") SUTURING TECHNIQUES. Scott, W. P. (Charlotte Memorial Hospital, NC). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 124: No. 4, 560-564(Aug 1975).

Permanent and removable interstitial implantation techniques for neoplasm radiotherapy using absorbable and unabsorbable sutures are described. Most of these techniques can be performed in the clinic easily and quickly with basic instruments: needle holder, needle book, and hemoclips. Specifically, ^{192}Ir (74.4 day half life, 300 to 610 keV, and 6.0 cm hvl in tissue) nylon ribbon and ^{125}I (60 day half life, 27 to 35 keV, and 2.0 cm hvl in tissue) Vicryl sutures are described. A major advantage of the ^{125}I over the ^{192}Ir seed (other than the fact that it can be permanently implanted and needs less radiation protection) is that the patient does not remain highly radioactive for as long a period due to the extremely low ^{125}I energy and may be allowed to leave the hospital. Both nuclides have the advantage of a long shelf life, making their use practical and economically feasible. (auth)

984 RADIATION EXPOSURE FROM ^{131}I-CONTAINING RADIONUCLIDES. Brent, R. L. (Stein Research Center, Philadelphia). J. Pediatr.; 84: No. 5, 788(May 1974).

The use of ^{131}I-rose bengal for diagnosis of bile ascites is discussed. The major source of irradiation is from the beta decay of ^{131}I and target organs such as the thyroid may absorb substantially higher doses of radiation than the whole body. It is emphasized that the thyroid should be blocked by administering Lugol's solution before and for five days after administration of the radionuclide. (HLW)

985 CHANGE OF SOME PROPERTIES OF RED BLOOD CELLS OF THE VENOUS BLOOD FROM MINERS WORKING IN

DEEP URANIUM MINES. Nosek, J. (Factory Inst. of National Health, Pribram, Czech.). Rev. Czech. Med.; 20: No. 4, 201-209(1974).

Studies were conducted on: lead and uranium content of red blood cells of uranium miners in relation to number of years spent in the mines; bonding of uranyl ions from external environment with red blood cells of miners; content of cholesterol, GPT transaminase, cholinesterase, and glutathione in red blood cells of miners; and metabolic changes in red blood cells of miners. (HLW)

986 INTERNAL HEPATIC RADIOTHERAPY. I. Organ Distribution of Colloidal $^{32}CrPO_4$ Injected into a Peripheral Vein, the Portal Vein, or the Arterial Supply of the Gastrointestinal Tract in the Rat. Nolan, T. R.; Grady, E. D.; Crumbly, A. J.; LaRose, J. H.; Cheek, W. V. (Georgia Inst. of Tech., Atlanta). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 124: No. 4, 590-595(Aug 1975).

Metastatic cancer of the liver is a disease that once clinically established can only be treated with palliative results, with rare exceptions, and has been reported in 64 percent of patients originally operated for cure. It was proposed to treat the disease with a prophylactic dose of internal irradiation using colloidal $Cr^{32}PO_4$. Results in rats showed that with an intravenous isotope injection the bone marrow has a high uptake of the $Cr^{32}PO_4$; however, when injected by the enteric intra-arterial method the amount of bone marrow $Cr^{32}PO_4$ uptake is approximately one-third that of the intravenous route. This difference is significant as the bone marrow is a radiosensitive organ. The enteric intra-arterial injection method accomplished the basic goals of homogeneous distribution of radioactivity within the liver, with a low level of systemic radioactivity, except in the spleen, and no evidence of radiation hazard to environment or attendants. The distribution of the radiation within the liver is also critical because the effective distance that the beta particles from the ^{32}P travels is only 3 mm. It can be seen that if an even distribution is not obtained, there may be areas which receive little or no irradiation, hence any malignant cells in such an area will not be treated and may continue to grow. Both the intra-arterial and intravenous route give homogeneous distribution, as shown in autoradiographs. The intraportal vein route, while having the lowest bone marrow uptake, had an unacceptable nonhomogeneous distribution. The method described produces localized, concentrated irradiation within the liver, and except for the spleen, spares other organs from high radiation dose. The results are predictable and reproducible. (CH)

987 RADIATION DOSE TO THE HUMAN BODY FROM INTRAVENOUSLY ADMINISTERED ^{75}Se-SODIUM SELENITE. Jereb, M.; Falk, R.; Jereb, B.; Lindhe, C. (Karolinska Hospital, Stockholm). J. Nucl. Med.; 16: No. 9, 846-850(Sep 1975).

The dose of radiation to the human body and some of its organs after intravenous administration of ^{75}Se-sodium selenite for diagnostic purposes was calculated on the basis of followup of 26 patients for as long as 517 days with measurements of: the retention of ^{75}Se in the whole body; the retention of ^{75}Se in the blood, liver, kidneys, ovaries, testicles, and hair, and the excretion of ^{75}Se in urine and feces. Whole-body counting and profile scanning were done on the patients and samples of blood from different organs, urine, and feces were measured for radioactivity. The dose of radiation received was calculated for an average patient of 70 kg. These doses were found to be slightly higher than previously reported on a smaller number of patients and with a shorter followup. They were slightly lower than those from ^{75}Se-methionine to the whole body but higher to the liver and kidneys. The margin of error in this investigation was estimated to be about 20 percent for the whole-body dose and probably higher for different organs, mostly due to the poorly known rate of retention of selenite in different organs. (auth)

988 SUMMARY OF CURRENT RADIATION DOSE ESTIMATES TO HUMANS FROM ^{123}I, ^{124}I, ^{125}I, ^{126}I, ^{130}I, ^{131}I, AND ^{132}I AS SODIUM IODIDE. J. Nucl. Med.; 16: No. 9, 857-860(Sep 1975).

Radiation dose estimates are presented for the whole body, thyroid, testes, stomach mucosa, red bone marrow, ovaries, and liver of a euthyroid adult following oral administration of a single dose of sodium iodide labelled with ^{123}I, ^{124}I, ^{125}I, ^{126}I, ^{130}I, ^{131}I, or ^{132}I. (CH)

989 THORIUM DIOXIDE EFFECTS IN MAN: EPIDEMIOLOGICAL, CLINICAL, AND PATHOLOGICAL STUDIES (EXPERIENCE IN PORTUGAL). da Silva Horta, J.; Cayolla da Motta, L.; Tavares, M. H. (Faculty of Medicine, Lisbon). Environ. Res.; 8: No. 2, 131-159(Oct 1974).

The Portuguese Thorotrast series comprises 1230 traced individuals of a total of 2432 who received Thorotrast for diagnostic purposes between 1930 and 1955, and have been followed since then. Of those, 1039 received the drug systemically (most of them for cerebral angiography), and 191 locally. Among the 1230 traced cases, 901 individuals have died up to 31 December 1971, 23 from fatal blood dyscrasias (12 of which were acute leukemias), 104 from malignant tumors, 64 of which were liver tumors, the hemangioendotheliomas being the most frequent histological type found; 23 from liver cirrhosis and 13 from the late effects of cervical granulomata occurring after cerebral angiography. The follow up of these cases and of 726 controls roughly matched for age and sex, and the statistical analysis performed on the results have shown that the incidence of malignancies in general, particularly of acute leukemias and malignant neoplasias of the liver and of liver fibrosis (liver "cirrhosis") was significantly higher among the traced Thorotrast cases than among the controls and the general Portuguese population, even allowing for the peculiarities of the diseased series, after correction of the respective death rates by a calculated factor. The main morphological lesions found in pathological studies of this series (autopsies and biopsies) are local granulomata developed in the tissues where the drug had been spilled, liver fibrosis, and liver tumors. Of these, the most frequent types found are hemangioendotheliomas and cholangiocarcinomas. A multicentric hemangioendothelioma was found in the reticuloendothelial organs in 3 cases. Bone marrow lesions found have been leukemias or aplastic anemias. The authors conclude that Thorotrast must have been the cause of such pathological consequences, probably through its radioactivity, and therefore should not be used in human beings. (auth)

Animals

990 EFFECT OF LARGE DOSES OF ^{131}I-19-IODOCHOLESTEROL ON METAPYRALONE-INDUCED ADRENAL CORTICAL HYPERPLASIA IN DOGS. Anderson, B. G.; Beierwaltes, W. H.; Nishiyama, R. H.; Ice, R. D. (Univ. of Michigan, Ann Arbor). J. Nucl. Med.; 16: No. 10, 928-932(Oct 1975).

The potential use of ^{131}I-19-iodocholesterol to treat ACTH excess Cushing's disease was evaluated in the dog. Three normal female dogs were given LD_{50} radiation doses of ^{131}I-19-iodocholesterol without producing gross or histopathologically demonstrable change of the adrenals at autopsy 3 months later. The adrenal cortices of three dogs were made hyperplastic (to simulate the adrenal cortex in Cushing's disease) with ACTH and three with Metapyralone. In addition these six dogs were given LD_{50} doses of ^{131}I-19-iodocholesterol. Three months after treatment, the adrenal glands of the ACTH-treated dogs were not enlarged, the cortex was thicker than normal, and there were no changes attributable to irradiation. At 3 months, the Metapyralone-treated dogs had enlarged adrenals, widening of the adrenal cortex, and no necrosis or other changes attributable to irradiation. It is concluded that a therapeutic trial of ^{131}I-19-iodocholesterol in the treatment of Cushing's disease is not indicated. (auth)

991 INFLUENCE OF SEX AND CASTRATION OF RATS ON THE FREQUENCY OF DEVELOPMENT OF PLUTONIUM OSTEOSARCOMA. Sinyakov, E. G. Med. Radiol.; 20: No. 9, 59-61(Sep 1975). (In Russian).

The osteosarcomogenic effect of ^{239}Pu was studied in male and female rats 6 months of age (122 non-castrated and 128 rats castrated one mouth before administration of the isotope). As a result of roentgenographical and pathorrorphological investigations the author observed 62.5 and 27.7 per cent of osteosarcomas in non-castrated male and female animals and correspondingly 17.8 and 21.6 per cent in castrated ones. It was concluded that the greater frequency of osteosarcoma development in the males than in the females points to a more considerable role of the male sex hormones in this process. The disease of the osteosarcoma development in the castrated animals testifies to the effect of the hormonal background level on the osteosarcomogenesis process. (auth)

Nuclide Kinetics and Toxicology

992 (BNWL-SA--5360) CONSIDERATIONS IN DEVELOPING A WORK PLACE STANDARD FOR SAMPLING AIRBORNE URANIUM. Schwendiman, L. C.; Andersen, B. V.; Selby, J. M.; Waite, D. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1975. 17p. (CONF-750445--8). Dep. NTIS $4.00.

From conference on occupational health experience with uranium; Arlington, Virginia, USA (28 Apr 1975).

Developing a comprehensive standard for sampling airborne particulate uranium compounds in work areas requires an awareness of many technical and regulatory considerations. This paper calls attention to regulations, analytical requirements, and pro-

vides some observations relating to the mechanics of sampling in the work area. Regulatory requirements specify the need for exposure control through representative airborne sampling, yet in the case of uranium, bioassay is the more definitive method of evaluating personnel exposure. This consideration will influence the degree of sophistication in the air sampling program. The sampling standard should address the question of fixed vs. personal samplers, and how each should be used. Writing a standard for uranium in the nuclear fuel cycle presents a challenge and must resolve different viewpoints. (auth)

Man

Refer also to abstracts 595, 605, 978, and 1050.

993 (AAEC/IP-1) EFFECTS OF IONIZING RADIATION ON MAN. Watson, G. M. (Australian Atomic Energy Commission, Coogee). Aug 1975. 27p. Dep. NTIS (US Sales Only) $4.50.

This paper describes the major effects of ionizing radiation on man and the relationship between such effects and radiation dose, with the conclusion that standards of radiological safety must be based on the carcinogenetic and mutagenic properties of ionizing radiation. Man is exposed to radiation from natural sources and from man-made sources. Exposure from the latter should be regulated but, since there is little observational or experimental evidence for predicting the effects of the very small doses likely to be required for adequate standards of safety, it is necessary to infer them from what is seen at high doses. Because the formal relationship between dose and effect is not fully understood, simplifying assumptions are necessary to estimate the effects of low doses. Two such assumptions are conventionally used; that there is a linear relationship between dose and effect at all levels of dose, and that the rate at which a dose of radiation is given does not alter the magnitude of the effect. These assumptions are thought to be conservative, that is they will not lead to an underestimation of the effects of small radiation doses although they may give an overestimate. (auth)

994 (AAEC/IP-9) RADIATION HAZARDS OF URANIUM MINING AND MILLING. Fry, R. M. (Australian Atomic Energy Commission, Coogee). Sep 1975. 38p. Dep. NTIS (US Sales Only) $5.00.

Each of the radiological problems that arise in uranium ore mining and milling processes are examined. The radiation standards that should be applied and the procedures that should be adopted to minimize radiation exposure to all persons are set down in the Australian "Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1975." If the requirements of this code are adhered to, the radiological safety of miners, mill workers and members of the public can be assured. The major operational requirement is to ensure that exposure of miners over their working lives to radon and its daughter products does not lead to an unacceptable increase in their chance of contracting lung cancer. Studies on the incidence of lung cancer amongst underground uranium miners indicate that this risk will be small if lifetime exposures are kept below about 120 "working level months," even amongst underground miners who smoke cigarettes. Other hazards that must be controlled are exposure of miners and mill workers to external radiation and to dusts containing long-lived radioactive alpha emitting isotopes. Finally, the solid waste products from the mill (the tailings) which contain most of the naturally occurring radioactivity, must be properly impounded and after closure of the mill, stabilized to ensure long-term containment. Access by the public to the stabilized tailings must be controlled and habitation within the controlled area prohibited. (auth)

995 (INIS-mf-1406) DISTRIBUTION AND UPTAKE PATTERNS OF RADIOACTIVITY AND TRACE ELEMENTS IN BONE. Kantak, U. J. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 11p. (CONF-730495-5). INIS.

From 1st annual conference of Indian Association for radiation protection; Bombay, India (12 Apr 1973).

A study is carried out to evaluate the ingestion hazard from bone seeking radioelements. There are two methods by which investigations on the role of trace elements in the accretion process can be studied. The first method is to analyse a large number of samples from different age groups. The second is to study the uptake properties of bone in vitro. An account of the two methods is given and the results tabulated. (INIS)

996 THE DISTRIBUTION OF NATURAL ^{14}C IN THE HUMAN BODY AND THE TISSUE DOSES DUE TO IT. Rublevskij, V. P. Gig. Sanit.; No. 3, 48-50(Mar 1974). (In Russian).

For English translation see the journal Hyg. Sanit.

As a result of the unequal content of carbon in various organs and tissues the ^{14}C content and the tissue dose per gram of tissue will be different. The greater the dose, the greater the carbon content. The greatest absorbed dose is created in fatty tissue (4.9 mrad/year). The greatest equivalent dose is created in the bone marrow and gonads; if a conversion coefficient equal to 10 is assumed, the doses are respectively 9 and 6.5 mrad/year. The critical organ for ^{14}C entering the human organism via the diet, if a conversion coefficient of 10 is assumed, can be considered the bone marrow or gonads. However this proposal requires additional, experimental verification. (tr-auth)

997 EXPERIMENTAL METHOD OF ESTIMATING THE DEPTH OF ^{241}Am DEPOSITED IN THE CHEST. Toohey, R. E. (Argonne National Lab., IL). Health Phys.; 29: No. 3, 417-418 (Sep 1975).

An experimental method has been developed for use with a xenon-filled proportional counter to determine the effective depth of ^{241}Am deposited in a contaminated subject. The method was demonstrated by using such a counter to obtain a series of gamma-ray spectra of the scattered and primary quanta from a source of ^{241}Am covered with successive layers of Alderson-Rando tissue-equivalent material. The ratio of scattered (35 to 45 keV) counts to counts in the 60-keV peak is shown to be linearly dependent on the thickness of absorber covering the source. Such a method is especially applicable to radiation measurements made over the thorax, where it is necessary to distinguish between activity in the lungs and activity in the bones of the thoracic cage. (UK)

998 TWO CALIFORNIUM-252 INHALATION CASES. Poda, G. A.; Hall, R. M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC). Health Phys.; 29: No. 3, 407-409(Sep 1975).

A general description of a ^{252}Cf inhalation incident, personnel decontamination and precautionary medical treatment are presented in this paper. Californium urinary excretion was followed, some fecal analyses were carried out and in vivo measurements were made with a 4 x 8-in. NaI(Tl) detector. Bioassay data are evaluated to indicate gastrointestinal and urinary clearance rates. The effects of DTPA chelation and catharsis are discussed. (auth)

999 TWO APPROACHES TO DETERMINING ^{239}Pu AND ^{241}Am LEVELS IN PHOSWICH SPECTRA. Goans, R. E. (Oak Ridge National Lab., TN). 29: No. 3, 421-423(Sep 1975).

A computer unfolding procedure used to detect ^{239}Pu in the presence of ^{241}Am and natural human background (^{40}K) in phoswich spectra is discussed. Both a direct method and a method of successive stripping are presented for the determination of lung burdens of ^{239}Pu and ^{241}Am. Normally both algorithms are used to provide independent evaluations of the lung burdens. It is found experimentally that approximately 4.5 nCi of ^{239}Pu can be detected in the presence of 0.3 nCi of ^{241}Am. Limitations on minimum detectable activity are currently under investigation and will be discussed in a subsequent note. (UK)

1000 COMPARISON OF THORIUM GAMMA SPECTRA IN SMOKERS AND NONSMOKERS. Scott, L. M. (Oak Ridge Y-12 Plant, TN). Health Phys.; 29: No. 3, 418-419(Sep 1975).

In vivo gamma spectra for 42 smokers who exhibited the following average conditions; smoked for 25.6 yr, consumed 31.4 cigarettes/day, and was 45.3 yr of age, and 21 nonsmokers who averaged 47.7 yr of age and who had never smoked, were evaluated. Neither group had ever worked with radioactive material and all subjects were male. The data showed no significant difference in buildup of thorium in the lungs of the two groups. (UK)

Animals

Refer also to abstracts 598, 645, 982, 986, and 1027.

1001 (NVO-153, pp 449-463) ANALYSIS OF ^{239}Pu AND ^{241}Am IN NAEG LARGE-SIZED BOVINE SAMPLES. Major, W. J.; Lee, K. D.; Wessman, R. A. (LFE Environmental, Richmond, CA). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Methods are described for the analysis of environmental levels of ^{239}Pu and ^{241}Am in large-sized bovine samples. Special procedure modifications to overcome the complexities of sample preparation and analyses and special techniques employed to prepare and analyze different types of bovine samples, such as muscle, blood, liver, and bone are discussed. (CH)

1002 BEHAVIOR OF THORIUM-228 AND ITS DAUGHTER ISOTOPES IN THE RATS' ORGANISM FOLLOWING THEIR PERORAL ADMINISTRATION. Pavlovskaya, N. A.; Provotorov,

A. V.; Makeeva, L. G. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Gigieny Truda i Professional'nykh Zabolevanij). Gig. Tr. Prof. Zabol.; No. 5, 36-39(May 1974). (In Russian).

With a single, oral dose of a soluble thorium compound the accumulation of radionuclides of the thorium series (thorium-228, radium-224, lead-212) is completed in the organs and tissues in the first 3 to 6 hr after administration. The highest content of thorium-228, radium-224, and lead-212 on peroral administration is found in the skeleton, and is 0.15% for thorium-228, 14.6% for radium-224, and 7.6% for lead-212. The highest concentration of thorium-228 and radium-224 is observed in the bone marrow, and of lead-212 in the kidneys. Radium-224 deposited in the skeleton during the first few days after peroral administration is rapidly transferred from its localization sites to the blood, and enters the liver, spleen, and kidneys. (tr-auth)

1003 METHOD FOR INTRATRACHEAL INSTILLATION IN THE RAT. Morrow, W. G. (Battelle Pacific Northwest Labs., Richland, WA). Lab. Anim. Sci.; 25: No. 3, 337-340(1975).

A method was developed to provide safe, rapid, and accurate intratracheal instillation of radionuclides into the rat lung. Rats were anesthetized with halothane and suspended vertically on an animal support stand with rubber bands attached to the incisor teeth, holding the mouth open. A speculum was inserted into the trachea and the radionuclide was injected from a syringe through tubing inserted through the tracheal speculum into the trachea. The amount of radionuclide retained in the lung varied by less than a factor of 2 within groups of rats observed 4 hr-20 da after employing this method of instillation. When a volume of 2 ml was instilled, the radionuclide distribution between the left and right lung was similar to that observed following incorporation by inhalation. Instillations of less than 2 ml showed unequal distribution of radionuclide between the right and left lung. (auth)

1004 EXPERIMENTAL STUDY ON THE FATE OF RADIOACTIVE INORGANIC SUBSTANCE IN RAT SALIVARY GLANDS. Abe, T. (Gifu Univ., Japan). Gifu Daigaku Igakubu Kiyo; 22: No. 1, 7-36(Jan 1974). (In Japanese).

Using ^{45}Ca and ^{90}Sr as tracers, changings of administered dose in blood and salivary glands were studied at varying intervals after subcutaneous injection of the isotopes to rats, which were fed by various combinations of three kinds of diet, i.e., ordinary diet, low calcium diet, and high calcium diet. Radioisotopes were assayed on whole sample in liquid scintillation counter. The effects of stimulating the secretion of saliva and the excretion of urine were also studied by means of pilocarpine and hydrochlorothiazide to being obtained the fluctuations of ^{45}Ca and ^{90}Sr uptakes. In comparison with the values of ^{45}Ca specific activity and ^{90}Sr specific activity at varying intervals of salivary gland samples in relation to blood sample, the value of ^{45}Ca exceeded that of ^{90}Sr at every time interval in every group maintained with three experimental diets. The fraction of injected ^{45}Ca appearing in the submandibular gland was the greatest in the low calcium diet group. In the salivary glands, the value of ^{90}Sr specific activity was distinctly less than that in the blood. Changings of ^{45}Ca and ^{90}Sr attained by using pilocarpine and hydrochlorothiazide were also studied at varying intervals. In rats on the ordinary diet intake, the radioisotopes were taken up into the salivary glands in the group used pilocarpine about thirty minutes earlier. (auth)

1005 INVESTIGATIONS OF THE WHOLE BODY AND ORGAN RADIOACTIVITY AS WELL AS THE EXCRETION IN RATS AFTER INTRAVENOUS INJECTION OF ^{192}Ir. Schaefer, H. Berlin; Freie Univ. (1973). 57p. (In German). INIS.

Thesis.

As ^{192}Ir is increasingly being used in solid form and can enter into the organism during the production of soluble compounds, the knowledge of its distribution in the organism and its excretion is important to estimate a possible radiation damage. Investigations were thus carried out on the whole body and organ radioactivity as well as measuring the excretion of ^{192}Ir in urine and feces of 155 male Wistar rats after intravenous injection of 1.4 μCi ^{192}Ir in the form of ammonium hexachloroiridate (IV). The radioactivity in the whole body decreases a day after injecting the ^{192}Ir to about a fifth of the initial radioactivity. From the 14th day of investigation on, the effective half-life of the whole body radioactivity with two test series, is 26.2 days, with a further series, 26.1 days; the accumulated excretion in the urine and feces increases accordingly. Two hours after injecting the ^{192}Ir, the radioactivity is at its highest in the skeletal muscles, the whole blood, in the total skeleton as well as in the liver and kidneys. On the 40th day of investigation, the highest ^{192}Ir accumulation was found in the whole skeletal muscles and in the whole skeleton as well as in the kidneys, liver, small intestine, whole blood, spleen, lungs and testicles. The effective half-life in epididymis, skeletal muscles, kidneys, heart, liver, lungs, testes, suprarenal glands and whole blood is lower than in the other organs investigated. (GE)

1006 EFFECT OF STABLE SCANDIUM ON THE LONG-TERM WHOLE BODY RETENTION OF INTRAVENOUSLY ADMINISTERED ^{46}Sc CITRATE IN THE RAT. Byrd, B. L.; Watson, E. E.; Cloutier, R. L; Hayes, R. L. (Oak Ridge Associated Universities, Inc., TN). Health Phys.; 29: No. 3, 375-379(Sep 1975).

The effect of stable scandium on the whole-body retention and tissue distribution of ^{46}Sc (T/sub ½ equals 84 days) has been studied in the rat. In one group of animals high specific activity ^{46}Sc was administered intravenously; in another group ^{46}Sc with added stable scandium (0.5 mg/kg) was administered. The retention was followed for 333 days at which time the animals were killed and the distribution of the ^{46}Sc in various tissues determined. In general, administration of stable scandium produced pronounced increases in tissue concentrations, particularly in liver, marrow, intestine, and brain. A least-squares analysis indicated that three exponential components were required to fit the whole-body retention data from both groups of animals. It was found that stable scandium has a pronounced effect on the long-term whole-body retention of ^{46}Sc. The observed long-term biological half-times in rats for both ^{46}Sc and ^{46}Sc plus carrier were far in excess of that given in IRCP Publication 2, 1959, for ^{46}Sc (30 days). (auth)

1007 INFLUENCE OF LEAD ON CALCIUM AND STRONTIUM TRANSFER THROUGH THE DUODENAL WALL IN RATS. Gruden, N.; Stantic, M.; Buben, M. (Inst. of Medical Research and Occupational Hygiene, Zagreb). Environ. Res.; 8: No. 2, 203-206(Oct 1974).

Five-week-old female albino rats were given daily doses for 1 or 2 weeks of lead as acetate ranging from 2 mu g to 40 mg by gastric intubation and sacrificed on the 8th or 15th day of the experiment. Calcium-45 and ^{85}Sr were used as markers to assess the calcium and strontium transfer through the duodenal wall by the everted gut sac method of Wilson and Wiseman. Doses of lead acetate greater than 20 mu g per day decreased the transfer of both calcium and strontium across the duodenal wall and these transfers decreased further with increased doses of lead, an effect which was independent of whether the rats were killed on the 8th or 15th day of the experiment. Doses of lead acetate greater than 200 mu g per day, however, did not produce a further decrease in these transfers. The retention of both calcium and strontium in the intestinal wall was unaffected by the lead treatment. (auth)

1008 KINETICS OF LEAD RETENTION AND DISTRIBUTION IN SUCKLING AND ADULT RATS. Momcilovic, B.; Kostial, K. (Inst. of Medical Research and Occupational Hygiene, Zagreb). Environ. Res.; 8: No. 2, 214-220(Oct 1974).

The kinetics of lead distribution was studied in suckling and adult rats 8 days after a single intraperitoneal injection of ^{203}Pb. Marked differences were observed in the kinetics of lead retention and distribution in suckling as compared to adult rats. The rate of ^{203}Pb disappearance was lower in the whole body, blood and kidneys, but higher in the liver, while the deposition processes predominated in the brain, femur and teeth of sucklings as compared to adult animals. (auth)

Plants

Refer also to abstracts 602, 610, 623, and 625.

1009 (INIS-mf-1236, pp 150-166) STUDIES ON CONTAMINATION OF CEREALS FROM FALLOUT. Gegusch, H. (Staatliche Zentrale fuer Strahlenschutz, Berlin). 1972. (In German).

From Polish-German work group meeting; Warsaw, Poland (22 Jun 1970).

In radioactive pollution of environment. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)).

The distribution of fallout ^{90}Sr and ^{137}Cs was determined in rye and wheat after harvest. The ^{90}Sr content was highest in the dried matter of straw and chaff and lowest in flour. The highest ^{137}Cs levels were found in the dry matter of rye bran, whereas in wheat the chaff showed the highest activity. In 40% extracted rye flour the $^{137}Cs/^{90}Sr$ ratio was 13.4. This was the highest value observed. Discrimination against ^{90}Sr was greatest in flour. For rye grain and wheat grain the quantity of ^{90}Sr absorbed by plants from soil was 0.01% and 0.06%, respectively, of that present in the soil. The ^{90}Sr and ^{137}Cs content of rye and wheat grain amounts to about 1% of evaluated maximum permissible levels. (INIS)

Microorganisms

1010 (NVO-153, pp 187-196) INFLUENCE OF SELECTED VARIABLES ON TRANSPORT OF PLUTONIUM TO SPORES OF

ASPERGILLUS NIGER. Au, F. H. F.; Beckert, W. F. (National Environmental Research Center, Las Vegas, NV). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Studies were carried out on the influences of different chemical forms and concentrations of Pu at two hydrogen ion concentrations of the culture medium on uptake and transport of ^{238}Pu to the spores of Aspergillus niger. Results indicated that Pu, when added to the culture medium as dioxide microspheres, nitrate, or citrate complex, was transported to the spores, and that an almost linear relationship existed between transport and concentration. Raising the pH of the culture medium from 2.5 to 5.5 generally increased transport of Pu to spores for all three chemical forms. At Pu concentrations of 224 pCi/g in the culture media, and for both pH 2.5 and 5.5, transport of Pu to spores was approximately three times as high from the nitrate or citrate form as from the dioxide microspheres. (auth)

New Tracer Techniques

Refer also to abstracts 676, 713, 903, 987, and 988.

1011 (AED-CONF-75-141-008) APPLICATION OF THE BODY COUNTER FOR QUANTITATIVE DETERMINATION OF BLOOD LOSSES. Werner, E.; Einck-Rosskamp, P.; Kaltwasser, J. P. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany)). 1975. 13p. (In German). INIS.

From 6th scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik; Berlin, F. R. Germany (28 Apr 1975).

1 fig.; 6 refs. With abstract.

The detection of concealed bleeding causing hypoferric anaemia is often not easy, as chemical methods for quantitative demonstration of blood in the faeces are not fully reliable. When using ^{51}Cr-labelled erythrocytes, collection and processing of all faeces is necessary for a quantitative determination. As this is only practicable over a few days with in-patients, in-vivo labelling of the erythrocytes with ^{59}Fe is more promising for longer periods of investigation. The overall exogenic loss of blood can then be determined from the course of the whole-body activity and the specific activity of the blood. An exact calculation program in consideration of two iron metabolism models was established. This method does not demand much cooperation from the patient and is suitable for the verification or exclusion of the tentative diagnosis of concealed bleeding. The quantitative determination even of small blood losses does not interfere with a concurrent ferrotherapy. Appropriate timing of measurements can help to distinguish between continuous and intermittent bleeding including hypermenorrhoea. Some selected examples are discussed. (GE)

1012 (CEA-R--4680) BRONCHOGRAPHY USING TANTALUM AEROSOLS: AN EXPERIMENTAL INVESTIGATION OF LUNG CLEARANCE AND RETENTION. Causse, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Jul 1975. 108p. (In French). Dep. NTIS (US Sales Only) $8.50.

Thesis.

Lung clearance of tantalum used as contrast medium was studied in three animal species: rat, monkey, and cat. In rats and monkeys, 80 to 90 percent of the inhaled tantalum was removed with a half life of 10 to 30 hr, but the residual fraction was removed with a half life longer than 100 days; consequently persistent roentgenographic pictures could be observed. These results were in accordance with those obtained by other authors studying dogs and men (accidental inhalation of radioactive tantalum). In cats, about 98 percent was removed with a half life of 15 hr and the remaining fraction with a half life of 18 days. In the three species, the physiological lung clearance mechanisms did not seem disturbed. Microscopic examination showed the peribronchiolar localization of remaining tantalum in rats and monkeys, with proliferation of granulomes and fibrotic reaction. These results indicate the need for the greatest care when using tantalum in man in order to outline peripheral airways. (auth)

1013 (LA-UR-75-1710) SEARCH FOR BIOLOGICAL EFFECTS OF ^{13}C-ENRICHMENT IN DEVELOPING MAMMALIAN SYSTEMS. Gregg, C.; Ott, D.; Deaven, L.; Spielmann, H.; Krowke, R.; Neubert, D. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 33p. (CONF-751027-1). Dep. NTIS $4.75.

From 2nd international conference on stable isotopes; Oak Brook, Illinois, USA (20 Oct 1975).

Increasing diagnostic use of stable isotopes, especially in children and pregnant women, enhances the importance of studies on the biological isotope effects in sensitive mammalian systems. Experimental data on animal systems are meager. The mouse embryos was studied at various stages and mouse limb buds were studied in organ culture. Limb bud development in vitro was unaffected by incubation with 82 mol percent ^{13}C-glucose as judged by either morphological or biochemical criteria. Of 271 preimplantation embryos incubated in vitro, 95.2 percent developed normally; in ^{13}C-enriched medium, 96.5 percent showed normal development. ^{13}C-Enrichment of the embryos in vitro is over 60 percent. Administration of 1.2 g glucose-U-^{13}C to pregnant mice during organogenesis leads to enrichment of maternal liver glycogen to over 17 mol percent ^{13}C, about one-third this level in the embryo, and a lower level in maternal blood. The absolute ^{13}C content of the embryo continues to increase for several days after the end of isotope administration, while the enrichment in maternal tissues falls. The lipid fraction of the fetus is most highly labeled shortly after the end of isotope administration. These studies on developing mammalian systems have not yet revealed any alteration of normal development due to stable isotope enrichment. (auth)

1014 (NVO-153, pp 97-124) ABSORPTION, DISTRIBUTION, AND EXCRETION OF PLUTONIUM BY DAIRY CATTLE. Stanley, R. E.; Bretthauer, E. W.; Sutton, W. W. (National Environmental Research Center, Las Vegas, NV). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

In order to obtain information on the potential transport of ingested Pu and to gain additional information on Pu deposition patterns in ruminants, a series of metabolism studies with dairy cows were conducted. Results are presented on tissue uptake following oral ^{238}Pu administration. (CH)

1015 (NVO-153, pp 125-131) GRAZING STUDIES ON SELECTED PLUTONIUM-CONTAMINATED AREAS IN NEVADA. Smith, D. D. (National Environmental Research Center, Las Vegas, NV). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

A grazing study in Area 13 of the Nevada Test Site (NTS) was initiated in May of 1973 and is proceeding on schedule. The accomplishments to date in this study include the quarterly collection of ingesta samples from fistulated steers, the quarterly sacrifice and sampling of a goat, the semiannual sacrifice and sampling of selected adult and young cattle, and the quarterly determination of digestibility of range plants. Dietary habits were tabulated with favored plant species being: two grasses, Indian ricegrass and galleta; two shrubs, winter fat and four-winged saltbush; and one forb, Russian thistle. Other analytical data are not yet available. (auth)

1016 CHARACTERIZATION OF PREPARATIONS OF RADIOIODINATED HUMAN CHORIONIC GONADOTROPIN. Morgan, F. J.; Kaye, G. I.; Canfield, R. E. Isr. J. Med. Sci.; 10: No. 10, 1263-1271(Oct 1973).

Evidence is provided that the iodination of native hCG by the chloramine-T method adds iodine almost exclusively to the α-subunit. It is shown that it is possible to iodinate isolated hCGβ-submit and then recombine it with hCGαsubunit to produce an active hormone. Experiments are also described in which ^{125}I-hCGβ-subunit is combined with ^{131}I-hCGα-subunit to produce a double-labeled hormone which has been used to study the fate of both subunits simultaneously. (INIS)

1017 DETECTION OF NEOPLASTIC LESIONS WITH RADIOGALLIUM (^{67}Ga CITRATE). Clinical-Statistical Report on 125 Cases. Palermo, F.; Patrese, P. (Ospedale Generale Regionale, Treviso (Italy. Istituto di Radioterapia e Medicina Nucleare). Radiol. Clin. Biol.; 43: No. 6, 509-520(1974).

3 tables, 8 figs., 7 refs.

^{67}Ga citrate is used in scanning human neoplasms since it has a particular affinity for malignant proliferations in soft tissues. The authors have examined 125 subjects: 98 with various types of malignancy and 27 with benign dysplastic, granulomatous, or inflammatory diseases. Serial scintiphotographic and scintigraphic recordings of areas with pronounced uptake of gallium were carried out within 72 h of its administration (or later). Agreement with histological data was ascertained in 75% of neoplastic and non-neoplastic patients: still such frequency, in relation to the whole of the observations, did not show an index high enough for statistical trustworthiness. If considered as limited to tumors of the lung, liver, mammary glands, and to

lymphomas, gallium with the help of statistical data is shown to be a screening device between benign and malignant proliferations. (INIS)

1018 IZOTOPNAYA BIOINTROSKOPIYA. (Isotopic Biointroscopy). Levkovich, A. D.; Lyutsko, A. M.; Pertsev, A. N. Moscow; Atomizdat (1973). 200p. (In Russian).

Isotopic biointroscopy is a possible method for studying processes that take place in optically opaque media. The method is especially important in medical and biological studies. Problems are discussed of detecting, transferring, recording, and interpreting introscopic information. A large part of the material is based on studies made by the authors. Based on proposed theoretical models, the state of the method, and possibility of its improvement and future development are analyzed. (tr-auth)

1019 MEASUREMENT AND DISTRIBUTION OF RADIOACTIVITY OF THE ^{14}C OF THE IAA-1-^{14}C IN LENS. Nowakowski, W. (Instytut Hodowli i Aklimatyzacji Roslin, Radzikow (Poland)). Bull. Acad. Pol. Sci., Ser. Sci. Biol.; 21: 455-457 (1973). (In French).

The distribution of radioactivity of the ^{14}C of the IAA-1-^{14}C was observed in the roots, stems, and cotyledons of Lens culinaris, in three different extracts: aqueous, alcoholic, and ceronic. The highest radioactivity of IAA-1-^{14}C was observed in the aqueous extract of roots, stems, and cotyledons of Lens culinaris. The roots of the Lens show the highest radioactivity of IAA-1-^{14}C. (auth)

1020 THE INCORPORATION OF $^{14}CO_2$ INTO SORBITOL AND OTHER COMPOUNDS IN SANTA ROSA PLUM LEAVES. De Villiers, O. T.; Meynhardt, J. T.; De Bruyn, J. A. (Fruit and Food Technology Research Inst., Stellenbosch (South Africa)). Agroplantae.; 6: 55-58(1974).

The distribution of ^{14}C activity in the alcohol-soluble fraction of Santa Rosa plum leaves showed that during short periods of photosynthesis in $^{14}CO_2$ the main products were located in the phosphorylated compounds and to a lesser extent in aspartic acid and malic acid. After longer exposures to $^{14}CO_2$, α-alanine, serine, aspartic acid, glyceric acid, malic acid, the phosphorylated compounds, sucrose and sorbitol showed relatively high ^{14}C activities. By far the highest ^{14}C activity was located in sorbitol, which had about 50 per cent of the total ^{14}C activity after 15 minutes. Sorbitol appears to be the principal end-product of photosynthesis in Santa Rosa plum leaves. (INIS)

1021 THE ROLE OF ^{99m}Tc-POLYPHOSPHATE BONE SCINTIGRAPHY IN BONE METASTASIS FROM BREAST CANCER. Bouwer, E. L.; Van Zyl, J. A.; Van Zyl, J. J. W. (Tygerberg Hospital, Stellenbosch (South Africa). Dept. of Surgery); Van Heerden, P. D. R. (Tygerberg Hospital, Stellenbosch (South Africa). Dept. of Internal Medicine). 12: No. 3, 177-179(Sep 1974). (In Afrikaans).

In 110 patients with proven breast carcinoma regularly repeated ^{99m}Tc-polyphosphate bone scintigrams and skeletal radiographic surveys demonstrated bone metastasis in 23 patients. In six of these patients, both the scintigrams and the radiographs were positive for metastasis. In 13 of the patients, however, the scintigrams were positive while the radiological examination was negative. In two cases, the opposite was true, the scintigrams being negative and the radiographic examination positive. In two other cases, the radiographic examination demonstrated metastasis while the scintigrams were doubtfully positive. The place of ^{99m}Tc-polyphosphate bone scintigraphy in the routine evaluation of patients with breast carcinoma is briefly discussed. (INIS)

1022 PHYSICAL ASPECTS OF ^{99m}Tc, ^{87m}Sr, AND ^{18}F FOR BONE SCINTIGRAPHY. Van Aswegen, A.; Lotter, M. G.; Van Zyl, W. H.; Minnaar, P. C. (University of the Orange Free State, Bloemfontein (South Africa). Dept of Biophysics); Iturralde, M.; Anderson, J. D. (University of the Orange Free State, Bloemfontein (South Africa). Dept. of Radiotherapy). S. Afr. Med. J.; 48: 2283-2288(13 Nov 1974).

The physical properties of ^{99m}Tc, ^{87m}Sr, and ^{18}F as bone scanning agents for a scintillation camera fitted with a medium energy diverging collimator, were determined. This was done by incorporating the plane source sensitivity, the modulation transfer function, and the figure of merit. From the results it is clear that ^{99m}Tc is superior to ^{87m}Sr and ^{18}F. (INIS)

1023 RADIONUCLIDE BONE IMAGES IN HYPERTROPHIC PULMONARY OSTEOARTHROPATHY. Terry, D. W. Jr.; Isitman, A. T.; Holmes, R. A. (Medical College of Wisconsin, Milwaukee). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 124: No. 4, 571-576(Aug 1975).

Hypertrophic pulmonary osteoarthropathy (HPO) can be differentiated from osseous metastasis on conventional bone images using technetium 99m radiopharmaceuticals. Periosteal new bone formation appears as symmetric circumferential deposition of radionuclide in the diaphyseal cortex of tubular bones. In contrast, asymmetrical deposits in the medullary canal are indicative of metastatic disease. The etiologies of hypertrophic osteoarthropathy are discussed. (auth)

1024 LOCALIZATION OF /sup 99m/Tc POLYPHOSPHATE IN SOFT TISSUE MALIGNANCIES. Richman, L. S.; Gumerman, L. W.; Levine, G.; Sartiano, G. P.; Bogg, S. S. (Univ. of Pittsburgh). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 124: No. 4, 577-582(Aug 1975).

From 75th annual meeting of the American Roentgen Ray Society; San Francisco (24 Sep 1974).

The distribution of /sup 99m/Tc polyphosphate in the P1798 lymphoma in mice was studied in order to determine the mechanism of localization of this radiopharmaceutical in nonosseous neoplastic tissues. Ten to 15 of /sup 99m/Tc stannous polyphosphate was intravenously injected into patients referred to the nuclear medicine division for a bone scan. Approximately 500 bone scans performed during the past 18 months were analyzed for the presence of radiopharmaceutical localization in soft tissue neoplasms. Results showed good uptake in a number of soft tissue tumors. (CH)

1025 BRAIN SCAN IN CEREBROVASCULAR 'MOYAMOYA' DISEASE. Mori, H.; Maeda, T.; Suzuki, Y.; Hisada, K.; Inoue, M.; Kadoya, S. (Kanazawa Univ., Japan). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 124: No. 4, 583-589(Aug 1975).

Cerebrovascular Moyamoya disease is characterized by peculiar angiographic features which consist of an abnormal net-like blood vessel pattern in the base of the brain associated with narrowing or occlusion of both internal carotid arteries at the level of the siphon. Brain scans using /sup 99m/Tc-pertechnetate were abnormal in 2 of 6 patients with cerebral Moyamoya disease. The spatial and temporal scan patterns were analogous to those described in conventional cerebral infarction. Cerebral infarction due to emboli resulting from mural thrombi may explain the uptake of radioisotope. None of the scans was abnormal in 4 adult patients in which the disease was complicated by subarachnoid hemorrhage. (auth)

1026 RADIONUCLIDE PERFUSION LYMPHANGIOGRAPHY: AN EXPERIMENTAL TECHNIQUE TO COMPLEMENT THE STANDARD ETHIODOL LYMPHANGIOGRAM. Steckel, R. J.; Furmanski, S.; Dunham, R.; Collins, J. D.; Ross, N.; Snow, H. D.; Poe, N. (Univ. of California, Los Angeles). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 124: No. 4, 600-609(Aug 1975).

From 75th annual meeting of the American Roentgen Ray Society; San Francisco (24 Sep 1974).

Radionuclide perfusion lymphangiography using /sup 99m/Tc-albumin requires a bipedal cannulation of peripheral lymphatics and may therefore be performed as an examination preliminary to standard Ethiodol lymphangiography. Experience in 13 dogs, including 2 with disseminated lymphosarcomas, and in a pilot series of 41 patients with various disorders, has shown the ability of this radionuclide technique to provide rapid gross visualization of lymph flow patterns and groups of nodes in the lymphatic chains of the extremities, the lateral pelvic walls, and the periaortic regions. In the 2 animals with generalized lymphosarcoma, and in the 21 patients in whom definitive pathologic or clinical proof of lymph node normality or involvement by tumor is now available, there have been no false negative radionuclide perfusion lymphangiograms. (auth)

1027 CLINICAL APPRAISAL OF A NEW LYOPHILIZED /sup 99m/Tc STANNOUS PYROPHOSPHATE KIT FOR SKELETAL IMAGING. Anderton, N. S.; Monroe, L.; Burdine, J. A. (Baylor Coll., Houston, TX). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 124: No. 4, 625-629(Aug 1975).

The purpose of this investigation was to evaluate /sup 99m/Tc SnPyP in relation to a bone imaging agent with a known level of accuracy. Strontium-85 chloride was selected for the comparison in rabbits because this radionuclide, when properly used, results in the highest lesion-to-background ratio of any of the commonly used radiopharmaceuticals. (auth)

1028 PREPARATION OF A REAGENT FOR THE RADIOIMMUNOLOGICAL DETERMINATION OF TESTOSTERONE. (To Instituto Farmacologico Serono S.p.A.). Netherlands Patent 7,314,599/A/. 24 Oct 1973. 4p. (In Dutch).

The chemical preparation of testosterone-3-(O-carboxymethyl) oxime-tyrosine-methylester is described. This serves as a reagent for the radioimmunoassay of testosterone. (NL)

1029 PREPARATION OF ^{32}P-LABELED INOSITIDES AND THEIR DEGRADIATION BY SOLUBLE KIDNEY ENZYMES. Lapetina, E. G.; Seguin, E. G.; Agranoff, B. W. (Univ. of Michigan,

Ann Arbor). Biochim. Biophys. Acta; 398: No. 1, 118-124(Jul 1975).

A method is described for the preparation of radioactive inositol lipids for studies of their enzymic degradation. Kidney cytosol fractions have been used to produce diesteratic cleavage. High voltage electrophoresis at pH 4.3 is used to separate D-myoinositol 1 : 2-cyclic phosphate and D-myoinositol 1-phosphate from hydrolysis of phosphatidylinositol. Radioactivity comigrating with myoinositol diphosphate and triphosphate is separated by electrophoresis at pH 1.5 following enzymatic hydrolysis of phosphatidylinositol phosphate and phosphatidylinositol diphosphate. Relative activities for hydrolysis of the various inositides suggest the presence of more than one phosphodiesterase. (auth)

1030 ISOLATION OF NEWLY SYNTHESIZED MYOSIN FILAMENTS FROM SKELETAL MUSCLE HOMOGENATES AND MYOFIBRILS. Etlinger, J. D.; Zak, R.; Fischman, D. A.; Rabinowitz, M. (Univ. of Chicago). Nature (London); 255: No. 5505, 259-261(15 May 1975).

A procedure is described for isolation of newly synthesized myosin filaments from skeletal muscle homogenates and myofibrils of rats. To investigate the significance of the easily releasable filaments, rats were injected with tritiated leucine. At intervals the animals were killed and the isolated filaments were prepared. The residual undispersed myofibrils were also prepared. The specific activity of the myosin heavy chain in the filament fractions was higher than that obtained from residual myofibrils. (HLW)

1031 NEUTRON RADIOGRAPHY IN RADIOBIOLOGIC EXPERIMENT WITH THERMAL NEUTRONS. Hermanska, J.; Hrdlicka, Z.; Prouza, Z.; Rakovic, M. Cas. Lek. Cesk.; 113: No. 28, 863-866(12 Jul 1974). (In Czech).

The neutron radiography method for establishment of thermal neutrons flux-density distribution in the radiobiologic irradiation of biologic objects in the nuclear reactors is suggested. (auth)

1032 LUNG SCANNING USING MICROSCOPHERES LABELLED WITH RADIOACTIVE ISOTOPES IN THE DIAGNOSIS AND EVALUATION OF THERAPEUTIC RESULTS IN PULMONARY MALIGNANT NEOPLASMS. Dziuk, E.; Dzurak, W.; Siekierzynski, M.; Jedrzejczak, W. W.; Czarnecki, C. Pol. Arch. Med. Wewn.; 53: No. 3, 241-253(Mar 1975). (In Polish).

In 25 patients with pulmonary malignant neoplasms, 39 scintigraphies were done using albumin microspheres labelled with 131-iodine, technetium-99m or indium-113m. In 10 patients with infiltrations of the main bronchi or lobar involvement, nine cases of scintigraphy demonstrated complete lack of perfusion of one lung. In these cases routine radiological examinations demonstrated normal perfusion and aeration of the parenchyma of the involved lung. Among 13 cases of carcinoma situated in segmental or subsegmental bronchi in seven cases the areas of absent perfusion were larger than the lesions disclosed during radiological examination. Scintigraphy of the lungs was used also for assessment of the results of synchronized chemotherapy in malignant neoplasms of this organ. Scintigraphy is not harmful and may be repeated many times in the same case which permits to evaluate the size of perfusion disturbances in cases of malignant pulmonry tumors and may be helpful in selection of a proper therapeutic method. (auth)

1033 OBJECTIVE DIAGNOSIS OF CHRONIC ALCOHOLIC INTOXICATION USING RADIOISOTOPE HEPATOGRAPHY. Polenko, A. V. Zh. Nevropatol. Psikhiat.; 74: No. 9, 1384-1389 (1974). (In Russian).

A radioisotope hepatography makes it possible to depict some functional states of the liver in patients with a chronic alcoholic intoxication. Among the studied contigent, 90% displayed an increased absorbtive-excretional function of the liver. The curve of a hepatogram in 64.5% of the cases was characterized by a rapid and steep ascent of the absorbtive segment and a short plateau (a typical curve). In 25% it differed from the typical one only by a longer plateau which is encountered in patients with concomittant hepatic disorders (chronic hepatitis, hepotocholecystitis). The described curves are sufficiently pathognomic for chronic alcoholic intoxication. (auth)

1034 AGE-RELATED REFRACTORINESS OF PHA-INDUCED LYMPHOCYTE TRANSFORMATION. II. ^{125}I-PHA Binding to Spleen Cells from Young and Old Mice. Hung, C. Y.; Perkins, E. H.; Yang, W. K. (Oak Ridge National Lab., TN). Mech. Ageing Develop.; 4: 103-112(1975).

Using ^{125}I-labeled red kidney bean phytohemagglutinin (^{125}I-PHA), we have found that spleen cells from old BC3F$_1$ mice bind this plant mitogen equally well, if not better, than spleen cells from young BC3F$_1$ mice, although PHA-induced blastogenesis of spleen cells from old mice is sharply reduced. Analyses demonstrated that there is neither significant alteration of binding affinity nor decreased total number of membrane receptor sites for PHA in senescing mouse spleen cells. The amount of PHA which was initially bound to spleen cells in serum-free medium appeared to be insufficient for a subsequent full stimulation of blastogenesis ([^{3}H]thymidine incorporation) in either young or old mouse spleen cells; when washed free of unbound extracellular PHA and upon cultivation in serum-containing culture medium, spleen cells rapidly released more than 90% of the bound PHA. Also, temperatures which change cell membrane morphology played a significant role in the binding and retention of PHA. However, no difference was observed between young and old mouse spleen cells in all these phenomena of PHA–cell membrane interaction. (auth)

1035 INDIRECT METHOD FOR THE ESTIMATION OF LYMPH FLOW. de Lima, J. J. P.; Alcantara, P.; Santos Garcia, D. (Universidade de Lourenco Marques, Mocambique). Lymphology (Stuttgart); 6: 169-174(1973).

In the course of studies on the lymphatic circulation of the hind limbs of the dog carried out in our Laboratory, a method using radioactive tracer (^{125}I) was developed which allows the determination of some parameters related to lymph circulation: the mean transit time through a segment of the lymphatic system and the lymphatic flow. This technique is inocuous for the subject, causes a minimal disturbance of the physiological factors involved in lymph flow, and is based on some properties of constant flows through systems of labyrinths. (auth)

1036 CLINICAL ASSESSMENT OF LEFT VENTRICULAR REGIONAL CONTRACTION PATTERNS AND EJECTION FRACTION BY HIGH-RESOLUTION GATED SCINTIGRAPHY. Berman, D. S.; Salel, A. F.; DeNardo, G. L.; Bogren, H. G.; Mason, D. T. (Univ. of California, Davis). J. Nucl. Med.; 16: No. 10, 865-874(Oct 1975).

An improved, noninvasive, radionuclidic, gated blood-pool imaging technique was developed for clinical analysis of regional contraction abnormalities of the left ventricle and determination of ejection fraction. The principal innovations include high-resolution collimation, higher information density, improved method for dynamic aortic-mitral-diaphragmatic border delineation, accurate selection of the end-systolic gating interval through the use of the phonocardiogram, and accurate end-diastole by on-line gating immediately following the electrocardiographic QRS. The results of scintigraphic studies using /sup 99m/Tc-human serum albumin or /sup 99m/Tc-autologous erythrocytes as tracer were compared with selective radiopaque cineangiographic findings in 27 patients with cardiac disease; excellent correlations of ejection fractions and abnormal contraction patterns were demonstrated. In addition, the clinical usefulness in evaluating ventricular performance was demonstrated in 79 patients with acute and chronic coronary artery disease. (auth)

1037 ACCUMULATION OF /sup 99m/Tc-GLUCOHEPTONATE IN ACUTELY INFARCTED MYOCARDIUM. Rossman, D. J.; Strauss, H. W.; Siegel, M. E.; Pitt, B. (Johns Hopkins Medical Inst., Baltimore). J. Nucl. Med.; 16: No. 10, 875-878 (Oct 1975).

The distribution of /sup 99m/Tc-glucoheptonate in normal mice and its accumulation in acutely infarcted myocardium were studied in animals. Rapid blood clearance and low concentration of the tracer in normal myocardium were found in tissue distribution studies performed in mice. Experimental myocardial infarction was performed in nine dogs. Four hours after the intravenous injection of /sup 99m/Tc-glucoheptonate the uptake ratio of the myocardial infarcted area to normal myocardium was 20:1; to blood, 9:1; and to lung, 6:1. The greatest concentration of radiopharmaceutical in the infarcted tissue was noted in areas that had 20 to 10 percent of normal perfusion. Regions of infarction were clearly defined by external gamma scintigraphy. Clinical investigation of this tracer in humans appears warranted. (auth)

1038 TIME-DEPENDENT IMAGE QUALITY USING /sup 99m/Tc-PYROPHOSPHATE. Snow, R. M.; Weber, D. A. (Univ. of Rochester, NY). J. Nucl. Med.; 16: No. 10, 879-882 (Oct 1975).

Technetium-99m-labeled pyrophosphate has proved to be a useful skeletal-imaging agent. In this study, specific areas of the skeleton were imaged at times ranging from $^1/_2$ to 6$^1/_2$ hr after injection of /sup 99m/Tc-pyrophosphate. Count ratios between abnormal and normal bone with respect to adjacent soft tissue were obtained for selected regions of interest on computer-stored scintillation camera images. The results show that image quality improves most rapidly from $^1/_2$ to 2 hr, but further modest gain in quality does occur on views recorded between 2 and 6 hr. All lesions detected on the later images were also observed on the early ones and the ratios of uptake between abnormal and normal bone from computer-processed scintillation camera images did not change appreciably with time after the $^1/_2$-hr

images. Our results confirm the clinical impression that overall image quality is better on views obtained at least 3 hr after injection. Further delays in imaging beyond 3 to 4 hr after injection probably will not result in any appreciable gain in diagnostic accuracy. (auth)

1039 ACCUMULATION OF /sup 99m/Tc-DIPHOSPHONATE IN MALIGNANT PLEURAL EFFUSIONS: DETECTION AND VERIFICATION. Siegel, M. E.; Walker, W. J. Jr.; Campbell, J. L. II (Malcolm Grow USAF Medical Center, Washington, DC). J. Nucl. Med.; 16: No. 10, 883-885(Oct 1975).

Increased accumulation of radioactivity was observed in two cases of malignant pleural effusions during the performance of routine bone scans with /sup 99m/Tc-diphosphonate. This previously unreported finding was verified both qualitatively and quantitatively by appropriate scanning and laboratory techniques. (auth)

1040 DYNAMIC STUDIES WITH /sup 99m/Tc-HEDP IN NORMAL SUBJECTS AND IN PATIENTS WITH BONE TUMORS. Citrin, D. L.; Bessent, R. G.; McGinley, E.; Gordon, D. (Royal Infirmary, Glasgow). J. Nucl. Med.; 16: No. 10, 886-890(Oct 1975).

Blood clearance, urinary excretion, and spinal uptake of /sup 99m/Tc-HEDP (ethane-hydroxydiphosphonate) were measured in ten normal control subjects. Blood clearance from 15 min is biexponential. Approximately 70 percent of the administered activity was excreted in the urine within 6 hr of injection. Spine-to-background ratios rise sequentially with time. Net normal bone uptake rises little after 2 hr and improved visualization of the normal skeleton thereafter is due to reduction of blood background activity. In 13 patients with bone tumors, direct measurement of diphosphonate uptake by the tumor-involved and corresponding normal bone showed a continued rise in diphosphonate levels in the tumor-involved bone due to increased metabolic activity. (auth)

1041 LIVER-HEART IMAGING IN EVALUATING HEPATIC FOCAL DEFECT. Yeh, E. L.; Pohlmann, G. P.; Meade, R. C. (Columbia Hospital, Milwaukee). J. Nucl. Med.; 16: No. 10, 896-898(Oct 1975).

An edge defect in the superior area of the left lobe is difficult to evaluate on the liver scintiscan image. Eighty normal liver-heart images showed no focal separation between the liver and heart images. Four cases with suspicious edge defects in the superior area of the left lobe were also studied with liver-heart imaging. One case was well demonstrated to be due to right ventricular compression of the liver without focal separation of the liver-heart images. Three cases showed focal separation of the liver-heart images. One defect was diagnosed as amebic abscess and showed enlargement on the followup images. The other two cases were proven to have liver metastasis. Liver-heart imaging is a reliable technique in evaluating a suspicious defect in the superior area of the left lobe of the liver. (auth)

1042 FUNCTIONAL IMAGING OF INTRARENAL BLOOD FLOW USING SCINTILLATION CAMERA AND COMPUTER. Ishii, Y.; Kawamura, J.; Mukai, T.; Takahashi, M.; Torizuka, K. (Kyoto Univ.). J. Nucl. Med.; 16: No. 10, 899-907(Oct 1975).

In order to obtain spatial distribution of an index for regional blood flow at each element on a scintigraphic image of the kidney, we attempted the construction of the so-called functional image. After injecting a single bolus of ^{133}Xe into a renal artery by means of a catheter, this objective was accomplished using digital computer processing for a sequence of scintillation camera recordings of the following washout process from the kidney. This is expressed in a form of matrix of disappearance rate constant. Calculation for the rate constant, the flow index of the functional image, was done using either the least squares (LS) method or height-over-area (H/A) method. Although the former method was considered to be theoretically suitable without undue participation of background activities, the latter was preferred because of stable results for image construction. On reviewing the functional image thus obtained from 22 patients representing a variety of renal diseases, the H/A gave specific information concerning regional distribution of the perfusion integrity mainly related to the cortical part of the kidney. This is often difficult to accomplish utilizing the conventional method of compartmental analysis of the xenon washout curve or selective renal angiography. (auth)

1043 SCINTIGRAPHIC APPEARANCE OF BIFRONTAL EPIDURAL HEMATOMA: CASE REPORT. Rockett, J.; Hamilton, F.; Robertson, J.; Mainuddin, M. (Baptist Memorial Hospital, Memphis). J. Nucl. Med.; 16: No. 10, 908-909(Oct 1975).

A bifrontal and parasagittal epidural hematoma was detected on the brain scan. The scintigraphic appearance of this rare lesion is described. (auth)

1044 HEPATIC ARTERY-PORTAL VEIN FISTULA DETECTED ON HEPATIC FLOW STUDY: CASE REPORT. Sziklas, J. J.; Spencer, R. P. (Hartford Hospital, Farmington, CT). J. Nucl. Med.; 16: No. 10, 910-911(Oct 1975).

A man with a history of gunshot wounds with jaundice and a bruit over the upper abdomen is discussed. The /sup 99m/Tc-sulfur colloid scan revealed simultaneous perfusion of the liver with transit of the activity down the aorta. This was considered compatible with a fistula between the hepatic artery and portal vein (confirmed angiographically and at autopsy). An expanding aneurysm of the hepatic artery produced an enlarging focal parenchymal defect. (auth)

1045 RADIONUCLIDE SCINTIGRAPHY: A DIAGNOSTIC AID IN DELAYED TRAUMATIC SPLENIC RUPTURE: CASE REPORT. Shih, W. J. (Tri-Service Hospital, Taipei, Taiwan). J. Nucl. Med.; 16: No. 10, 912-914(Oct 1975).

The use of /sup 99m/Tc-sulfur colloid scintigraphy in the diagnosis of a delayed traumatic splenic rupture 10 days after injury is described. Splenic scintigraphy of patients falling in this category may help the clinician in the early detection of splenic rupture. (auth)

1046 RADIONUCLIDE STUDIES IN HEMANGIOENDOTHELIOMATOSIS: CASE REPORT. Sy, W. M.; Nissen, A. W. (Brooklyn-Cumberland Medical Center, NY). J. Nucl. Med.; 16: No. 10, 915-917(Oct 1975).

Hemangioendothelioma is a very rare, locally invasive vascular tumor. Multiple abnormal radionuclide studies of brain, lungs, kidneys, liver, and spleen were observed in a patient with hemangioendotheliomatosis. (auth)

1047 INCONSISTENT IMAGES OF THYROID NODULE SCINTIGRAMS MADE WITH IODINE AND PERTECHNETATE: CASE REPORT. Hirabayashi, S.; Koga, Y.; Kitahara, T.; Hishida, T.; Kiga, M.; Iino, S. (Showa Univ., Tokyo). J. Nucl. Med.; 16: No. 10, 918(Oct 1975).

In a patient with Hurthle cell adenoma, thyroid scans showed nodular trapping of /sup 99m/Tc-pertechnetate, but nodular binding of ^{131}I was not observed. (auth)

1048 FUNCTIONING METASTASES IN LIVER FROM THYROID CARCINOMA: CASE REPORT. Atmaram, S. H.; Ganatra, R. D.; Sharma, S. M.; Ramanna, L. (Bhabha Atomic Research Center, Bombay). J. Nucl. Med.; 16: No. 10, 919-921(Oct 1975).

Radioiodine uptake in liver metastases was observed in two patients with follicular carcinoma of the thyroid. (auth)

1049 SPLENOGONADAL FUSION: A RARE CONGENITAL ANOMALY DEMONSTRATED BY /sup 99m/Tc-SULFUR COLLOID IMAGING: CASE REPORT. Guarin, U.; Dimitrieva, Z.; Ashley, S. J. (Flushing Hospital and Medical Center, NY). J. Nucl. Med.; 16: No. 10, 922-924(Oct 1975).

A case report illustrating the value of spleen scanning of an infant in the diagnosis of a rare congenital /sup 99m/Tc-sulfur colloid anomaly characterized by fusion of the spleen and left testis is described. This malformation results from faulty organogenesis during the fifth to the eighth week of fetal development. Only 65 cases have been reported in the world literature. In most instances, the anomaly is recognized as an incidental finding at autopsy or at surgical exploration of the abdomen. In 20 percent of cases the anomaly is associated with osseous malformations such as peromelia, ectromelia, micrognathia, and talipes. (auth)

1050 FATE OF FOUR ^{75}Se-LABELED AMINO ACIDS: STUDIES OF SOME UNSUCCESSFUL PANCREAS-SCANNING AGENTS. Tothill, P.; Heading, R. C. (Royal Infirmary, Edinburgh). J. Nucl. Med.; 16: No. 10, 933-937(Oct 1975).

A number of alpha-amino acids labeled with ^{75}Se were developed in the hope of finding a pancreas-scanning agent superior to L-selenomethionine. Six were submitted for clinical trial and four were tested: D-selenomethionine and three derivatives of selenocysteine. Dynamic scintillation camera studies showed that liver uptake was substantial in all cases but that the time course of accumulation and removal differed between agents. Plasma radioactivity curves demonstrated differences in initial removal rates. Two of the agents showed evidence of incorporation of activity into protein and release into the circulation just as with L-selenomethionine. Whole-body counter measurements showed that the retention of activity from the agents exhibiting early plasma protein incorporation was similar to that of L-selenomethionine. Much of the activity from the other two agents was excreted faster but a small proportion was retained for a long time. Although the cumulated activity and absorbed dose were substantially less for at least two of the agents than for ^{75}Se-L-selenomethionine, the lack of sufficient pancreatic concentration renders them inferior as scanning agents. (auth)

1051 HEAD AND BRAIN SCAN FINDINGS IN RHINOCEREBRAL MUCORMYCOSIS: CASE REPORT. Zwas, S. T.; Czerniak, P. (Tel Aviv Univ., Israel). J. Nucl. Med.; 16: No. 10, 925-927 (Oct 1975).

Brain and bone scan findings in two patients suffering from rhinocerebral mucormycosis following kidney transplantation are presented. Two patients who had had kidney transplants and were sustained for over a month on immunosuppressive drugs developed a rare type of opportunistic fungal infection, namely mucormycosis. They were examined in various stages of their disease. Special attention was paid to the /sup 99m/Tc scintigraphic findings. (auth)

1052 IMPROVEMENT OF SCINTIGRAM RELIABILITY BY ISOCOUNT SCANNING AND MULTILEVEL ANALYSIS. Ikebe, J.; Nawa, O. A. (Tokyo Inst. of Tech.). J. Nucl. Med.; 16: No. 10, 938-943 (Oct 1975).

A new method for the computer processing of scan data is described. Given the target source conditions and the detector parameters, the isocount scanning uses optimally the available observation time by maintaining the statistical reliability of each measurement in the composition of a scintigram and by devoting all the observation time to the region of interest through logic circuits which allows quick skipping of the background region. The multilevel analysis is an effective enlargement of the dynamic range of the displayer screen density characteristics that emphasizes small uptake ratios in any density level. It also makes the feature extraction very easy by producing an animated sequence of pictures of the observed organ on the screen. The detectability of small uptake ratios significantly improved, specially in regions of low counting rate where the fluctuation of data severely degrades the picture quality in the conventional constant speed scanning method. (auth)

1053 MYOCARDIAL LOCALIZATION OF /sup 99m/Tc-PYROPHOSPHATE WITHOUT EVIDENCE OF ACUTE MYOCARDIAL INFARCTION. Soin, U. S.; Burdine, J. A.; Beal, W. (Baylor College, Houston, TX). J. Nucl. Med.; 16: No. 10, 944-946 (Oct 1975).

Localization of /sup 99m/Tc-pyrophosphate in the cardiac region during routine bone scanning for metastatic tumor is discussed in two cases. Clinical information as well as electrocardiographic and serum enzyme studies did not reveal any evidence of acute myocardial injury. The cause of myocardial localization of the radiopharmaceutical was not clear in these cases. (auth)

1054 DISTENDED GASTRIC FUNDUS: SIMULATION OF A LEFT SUPRARENAL MASS. Sorabella, P. A.; Slovis, T. L.; Fellows, R. A.; Johnson, P. M. (Presbyterian Hospital, New York). J. Nucl. Med.; 16: No. 10, 947-948 (Oct 1975).

A discrete region of low or absent activity during /sup 99m/Tc-DTPA scanning in the left suprarenal area, simulating an avascular mass on renal imaging or radionuclide angiography, can result from dilatation of the gastric fundus. (auth)

1055 GALLIUM-67-CITRATE SCANNING IN PRIMARY CANCER OF THE LIVER: DIAGNOSTIC VALUE IN THE PRESENCE OF CIRRHOSIS AND RELATION TO ALPHA-FETOPROTEIN. Levin, J.; Kew, M. C. (Johannesburg General Hospital). J. Nucl. Med.; 16: No. 10, 949-951 (Oct 1975).

Gallium-67-citrate and /sup 99m/Tc-sulfur colloid scans were performed in 38 South African blacks with primary hepatocellular cancer. Selective uptake of the radionuclide by the tumor occurred in 27 patients (70 percent). In 12 out of 18 patients with associated cirrhosis, ^{67}Ga was concentrated in the defect or defects visible on the /sup 99m/Tc-sulfur colloid scan, but in the remaining 6 cases (33 percent), the 2 scans were identical and the defects may have been attributed wrongly to cirrhosis. Alpha-fetoprotein (AFP) was detected by immunodiffusion in the serum of 26 patients. Twenty-one of these showed selective uptake of ^{67}Ga by the tumor as compared with 6 out of 12 patients in whom this protein could not be detected. We were therefore unable to confirm a previous finding of a greater uptake of the radionuclide in AFP-negative primary liver cancer. (auth)

1056 ENDOTOXIN AS A CAUSE OF ASEPTIC MENINGITIS AFTER RADIONUCLIDE CISTERNOGRAPHY. Cooper, J. F.; Harbert, J. C. (Univ. of Tennessee, Memphis). J. Nucl. Med.; 16: No. 9, 809-813 (Sep 1975).

The role of pyrogens in aseptic meningitis after radionuclide cisternography was studied by means of the Limulus test, a sensitive detector of endotoxin. During a 15-month period, 39 reactions associated with cisternography were reported. Ten samples of specific lots of the radioactive drugs implicated in 20 of these reactions were tested and all reacted strongly positive to the Limulus test. The less sensitive rabbit pyrogen test was negative for these preparations when tested on a dose-per-weight basis. Our findings apparently provide clinical evidence for the observation made in animals that endotoxin is at least 1,000 times more toxic intrathecally than intravenously. The data implicate endotoxin contamination as a cause of adverse reactions to radionuclide cisternography. We conclude that the USP pyrogen test is insufficiently sensitive for intrathecal injectables and should be supplemented by the Limulus test. (auth)

1057 GLYCOPYRROLATE IN /sup 99m/Tc-PERTECHNETATE BRAIN IMAGING. Holmes, R. A.; Luth, C. N. (Medical College of Wisconsin, Milwaukee). J. Nucl. Med.; 16: No. 9, 819-821 (Sep 1975).

Glycopyrrolate, a synthetic anticholinergic agent, was administered parenterally to two groups of patients referred for /sup 99m/Tc-pertechnetate brain imaging to assess its ability to suppress pertechnetate uptake by the choroid plexus, oral mucosa, and salivary (parotid) glands. Pertechnetate activity was almost completely eliminated from the choroid plexus and mouth and appeared to be moderately reduced in the parotid gland. The drug can be given orally and may prove valuable in pertechnetate brain imaging. (auth)

1058 SPLEEN-LUNG INTERFACE AS DIAGNOSTIC INFORMATION. DeLuca, S. A.; Kolodny, G. M. (Massachusetts General Hospital, Boston). J. Nucl. Med.; 16: No. 9, 822-824 (Sep 1975).

Left anterior, lateral, and posterior views on 50 consecutive /sup 99m/Tc-sulfur colloid lung scans were examined. Normal patients had continuity of activity between the left lung and the spleen on all three views. Patients with subphrenic abscess or large left pleural effusions showed no continuity between lung and spleen activity on any view, while other abnormalities, most commonly cardiomegaly, accounted for lack of lung-spleen continuity on the anterior view only. It is suggested that in all combined /sup 99m/Tc-sulfur colloid lung studies, the left side be examined as well as the right for abnormalities adjacent to the left diaphragm. (auth)

1059 SCINTIGRAPHY IN A CASE OF PSEUDOCYST OF LIVER: CASE REPORT. Poshyachinda, M.; Maturosakul, B.; Manothaya, C. (Chulalongkorn Univ., Bangkok). J. Nucl. Med.; 16: No. 9, 825-827 (Sep 1975).

Pseudocyst of the liver resulting from bile leakage into subcapsular region from undetermined cause is described. Liver scintigraphy using ^{131}I-BSP and ^{198}Au-colloids was correlated with the operative findings. (auth)

1060 POSTERIOR FOSSA SCINTIANGIOGRAPHY: DOCUMENTATION OF GENETIC PENETRANCE OF VON HIPPEL–LINDAU SYNDROME IN A CLINICALLY UNAFFECTED GIRL AND HER FATHER. Hattner, R. S. (Univ. of California, San Francisco). J. Nucl. Med.; 16: No. 9, 828-830 (Sep 1975).

The syndrome of von Hippel and Lindau is a rare hereditary disorder constituted by retinal angiomata, posterior fossa and spinal cord hemangioblastomata, cystic and adenomatous dysplasia of major organs, and occasionally renal cell carcinomata. Although the syndrome is transmitted by an autosomal dominant gene, the penetrance is variable and affected persons may have any or all of the elements of the disease. The 16-year-old clinically normal daughter of a patient with the von Hippel–Lindau syndrome demonstrated a vascular posterior fossa lesion on /sup 99m/Tc-DTPA scintiangiography that failed detection in delayed images. Contrast arteriography corroborated the presence of a hemangioblastoma. Noninvasive demonstration of the genetic penetrance of this disorder offers its victims an opportunity for low morbidity early surgical cure of the associated brain lesions. (auth)

1061 FOCAL NODULAR HYPERPLASIA OF THE LIVER: CASE REPORT. Uszler, J. M.; Swanson, L. A. (Harbor General Hospital, Torrance, CA). J. Nucl. Med.; 16: No. 9, 831-832 (Sep 1975).

An abnormal /sup 99m/Tc-sulfur colloid scan was observed in a patient with focal nodular hyperplasia of the liver. (auth)

1062 RADIONUCLIDE CEREBRAL ANGIOGRAPHIC EVALUATION OF A DIPLOIC EXTRACRANIAL MENINGIOMA: CASE REPORT. Klein, E. W.; Farhat, S. M.; Haskins, P. A.; Colvin, J. T. (St. Joseph Mercy Hospital, Ann Arbor, MI). J. Nucl. Med.; 16: No. 9, 833-834 (Sep 1975).

A case of a diploic extracranial meningioma whose true vascularity was more significantly defined by /sup 99m/Tc-pertechnetate radionuclide angiography than by selective contrast angiography

is presented. The radionuclide angiogram clearly demonstrated large venous channels draining the tumor. (auth)

1063 PREPARATION AND CHEMICAL CHARACTERIZATION OF RADIOIODINATED BLEOMYCIN. Meyers, J.; Krohn, K.; DeNardo, G. (Univ. of California, Davis). J. Nucl. Med.; 16: No. 9, 835-838(Sep 1975).

None of the radionuclides with which bleomycin has been labeled have chemical and nuclear properties that are entirely satisfactory for in vivo tumor localization. Bleomycin has been radioiodinated by the iodine monochloride, chloramine-T, and lactoperoxidase methods. Iodine monochloride proved to be the preferred method and conditions were developed whereby 80 percent of radioiodide was covalently bound to bleomycin. Bleomycin (140 mu g) was added to 200 mu l of saline/citrate buffer (pH 7.0) followed by radioiodide and iodine monochloride. This reaction mixture was incubated for 1 hr and purified by Sephadex G-10 chromatography. The iodine monochloride reaction product underwent hydrolytic deiodination in vitro at a rate of about 1.2 percent/day (0.15 M NaCl, 37^{0}C). Bleomycin A and B components were radioiodinated with equal efficiency on a mole fraction basis. (auth)

1064 COBALT-LABELED BLEOMYCIN: A NEW RADIOPHARMACEUTICAL FOR TUMOR LOCALIZATION. A Comparative Clinical Evaluation with Gallium Citrate. Poulose, K. P.; Watkins, A. E.; Reba, R. C.; Eckelman, W. C.; Goodyear, M. (Washington Hospital Center, Washington, DC). J. Nucl. Med.; 16: No. 9, 839-841(Sep 1975).

The efficacy of ^{57}Co-labeled bleomycin as a tumor-scanning agent was evaluated in 50 patients with malignant tumor. In terms of sensitivity, labeled bleomycin was found to be a superior agent for malignant tumor detection when compared with ^{67}Ga-citrate. Maximum sensitivity (96 percent) was found in epidermoid carcinomas. Because of rapid blood clearance and rapid excretion by the kidneys, interpretation of ^{57}Co-bleomycin scans is facilitated. (auth)

1065 MYOCARDIAL UPTAKE OF LABELED OLEIC AND LINOLEIC ACIDS. Beierwaltes, W. H.; Ice, R. D.; Shaw, M. J.; Ryo, U. Y. (Univ. of Michigan, Ann Arbor). J. Nucl. Med.; 16: No. 9, 842-845(Sep 1975).

Oleic acid labeled with ^{14}C, (^{14}C-OA) or ^{131}I (^{131}I-OA) and ^{131}I-labeled linoleic acid (^{131}I-LOA) were administered intravenously to rats and tissue distribution studies completed at various time intervals from 5 to 60 min. Tissue distribution of ^{131}I-labeled oleic acid or linoleic acid was also studied in dogs at 5- and 30-min time intervals after intravenous administration of the tracer dose. There were distinct differences in the patterns of tissue distribution between ^{14}C-OA, ^{131}I-OA, and ^{131}I-LOA. Radioactivity concentration in the myocardium was the highest at all time intervals in the rats given ^{131}I-OA only. In dogs, the myocardial uptake of ^{131}I-OA was significantly higher than the radioactivity in the blood or other tissues at 30 min after injection. The disappearance rates of ^{131}I-OA and ^{131}I-LOA were almost identical but myocardial concentration of ^{131}I-LOA at 30 min after the dose in the dog was half that of ^{131}I-OA whereas ^{131}I-LOA liver concentration was higher than that of ^{131}I-OA. Since the concentrations of the formulated ^{131}I-OA in the blood and in the myocardium are both highest at the earlier intervals, it should be difficult to detect myocardial ischemia or infarction with ^{131}I-OA scanning. (auth)

1066 ACCURACY OF BRAIN SCANNING IN PEDIATRIC CRANIOCEREBRAL NEOPLASMS. Gilday, D. L.; Ash, J. (Hospital for Sick Children, Toronto). Radiology; 117: No. 1, 93-97(Oct 1975).

From 60th scientific assembly and annual meeting of the radiological society of North America; Chicago, IL (1 Dec 1974).

A total of 2,563 children were studied by cerebral radionuclide angiography, immediate postinjection blood-pool imaging, and delayed 2- to 4-hr. brain scanning. Of 110 new neoplasms of the brain or skull examined, 90 percent were detected by these means. The scan did not appear to be as accurate in craniopharyngiomas ($^6/_{10}$) and brainstem tumors ($^5/_6$). Thirty-nine recurrent tumors not studied previously all produced positive brain scans. Meticulous positioning of the pediatric patient is necessary at all times for accurate results. (auth)

1067 REGIONAL PULMONARY FUNCTION IN SUPINE PATIENTS WITH MITRAL VALVE DISEASE. Surprenant, E. L.; Spellbert, R. D. (Univ. of California, Los Angeles). Radiology; 117: No. 1, 99-104(Oct 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Supine tidal volume regional ventilation and perfusion images obtained using ^{133}Xe and /sup 99m/Tc-MAA tracers in the posterior and lateral projections demonstrated several alterations in patients with mitral valve disease. Reversal of the gravitational perfusion gradient correlated with pulmonary venous and arterial hypertension; the supine studies reliably distinguished normal subjects from mitral patients. The reversed gradient was from posterior-base to anterior-apex. Focal defects were common and contributed to the reversed gradient in 50 percent of patients. Perfusion defects larger than those of ventilation, simulating emboli, occurred in 32 percent, particularly in the middle lob and superior segment areas. Relative hypoventilation of the le. lung was seen in 44 percent of these patients. (auth)

1068 EFFICACY OF COMBINED LIVER-LUNG SCINTILLATION IMAGING. Gold, R. P.; Johnson, P. M. (Columbia-Presbyterian Medical Center, New York). Radiology; 117: No. 1, 105-111(Oct 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

Of 116 patients who had undergone combined liver-lung scintillation imaging using /sup 99m/Tc-sulfur colloid and /sup 99m/Tc-MAA tracers 23 with negative studies had abnormal subphrenic spaces at operation, and 5 with positive studies had abnormal subphrenic spaces at laparotomy (hematomas, bile spillage, serous fluid, or abscess); 4 of 6 nonexplored positive studies showed resolution of defects on serial imaging. Other information obtained included abnormalities intrinsic to liver, lungs, or spleen; evidence suggestive of left subphrenic pathology; and reliable information about the right subphrenic space even in the presence of intrathoracic pathology, including effusions. (auth)

1069 ABNORMAL RADIONUCLIDE CEREBRAL ANGIOGRAMS AND SCANS DUE TO SEIZURES. Stevens, J. S.; Mishkin, F. S. (Martin Luther King, Jr. General Hospital, Los Angeles). Radiology; 117: No. 1, 113-116(Oct 1975).

The effect of recent seizures on the brain scan was determined in a retrospective study of patients who had had seizures. All patients who underwent brain scanning within eight days of seizures and who did not have a specific intracranial lesion were included. The /sup 99m /Tc-pertechnetate cerebral angiogram and/or delayed scan was abnormal in 73 percent of 22 patients. The data suggest that if seizures occur within six days of the brain imaging, the image is likely to be abnormal. (auth)

1070 DIAGNOSIS OF OSTEOMYELITIS IN CHILDREN BY COMBINED BLOOD POOL AND BONE IMAGING. Gilday, D. L.; Paul, D. J.; Paterson, J. (Hospital for Sick Children, Toronto). Radiology; 117: No. 2, 331-335(Nov 1975).

Differentiation of osteomyelitis from cellulitis or septic arthritis can be difficult. The radiological examination often does not have the characteristic features. Seventy of 71 children with osteomyelitis had focal areas of increased radioactivity demonstrated by /sup 99m/Tc methylene diphosphonate bone scans at the site of the infection. The addition of blood pool images aids in the interpretation of the study as they permit evaluation of the effect of hyperemia. The 13 children with cellulitis had diffuse increase in radioactivity involving both the bones and soft tissues. Bone imaging as the initial screening procedure for osteomyelitis is recommended. (auth)

1071 EARLY RADIONUCLIDE DIAGNOSIS OF ACUTE OSTEOMYELITIS. Duszynski, D. O.; Kuhn, J. P.; Afshani, E.; Riddlesberger, M. M. Jr. (Children's Hospital, Buffalo). Radiology; 117: No. 2, 337-340(Nov 1975).

Forty-two patients suspected of having early, acute osteomyelitis were studied by /sup 99m/Tc-Sn-pyrophosphate bone imaging. Of the 19 patients shown subsequently to have osteomyelitis, 18 had positive bone images. Only one of the radiographs taken at the same time was positive. The bone image provides a safe, accurate, noninvasive technique for the early diagnosis of osteomyelitis. (auth)

1072 LIVER IMAGING IN THE DIAGNOSIS OF HEPATIC VENOUS THROMBOSIS IN PAROXYSMAL NOCTURNAL HEMOGLOBINURIA. Staab, E. V.; Hartman, R. C.; Parrott, J. A. (Vanderbilt Univ., Nashville). Radiology; 117: No. 2, 341-348 (Nov 1975).

Eleven patients with paroxysmal nocturnal hemoglobinuria were studied by serial liver imaging using /sup 99m/Tc-sulfuric colloid. This disease has a generalized thrombotic tendency, and progressive diffuse hepatic venous thrombosis has been emphasized in recent studies. Radionuclide imaging proved to be of great help in establishing the diagnosis of hepatic venous thrombosis and following the progress of the disease process. Abnormal patterns in hepatic venous occlusion include enlargement of the liver (especially the right lobe), extrahepatic localization of radionuclide, and areas of decreased uptake in the distribution of the involved veins. These findings develop rapidly and are very characteristic in the clinical setting. (auth)

1073 LIVER SIZE DETERMINATION IN PEDIATRICS USING SONOGRAPHIC AND SCINTIGRAPHIC TECHNIQUES. Holder, L. E.; Strife, J.; Padikal, T. N.; Perkins, P. J.; Kereiakes, J. G. (Cincinnati General Hospital). Radiology; 117: No. 2, 349-353 (Nov 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago (1 Dec 1974).

Knowledge of the normal liver size is essential for making the scintigraphic estimate of hepatomegaly. A nomogram for sonographic liver size versus height of the patient was developed for the normal pediatric patient. Liver size was measured as the longitudinal liver length in the plane midway between the xiphoid and the right lateral liver margin. Scintigraphic and sonographic measurements showed a good correlation. The scintigraphic nomogram was developed using the experimentally determined relationship between the two modalities. (auth)

1074 DYNAMIC/STATIC BRAIN SCINTIGRAPHY: AN EFFECTIVE SCREENING TEST FOR SUBDURAL HEMATOMA. Brown, R.; Weber, P. M.; dos Remedios, L. V. (Kaiser-Permanente Medical Center, Oakland, CA). Radiology; 117: No. 2, 355-360(Nov 1975).

Dynamic /sup 99m/Tc-pertechnetate perfusion scintigraphy of the brain was coupled with the delayed static scan in 5,853 studies as a screening test for neurological disease. Of approximately 1,000 patients referred for investigation for possible subdural hematoma (SDH), 23 proved to have SDH at surgery. Their scintigraphic abnormalities were analyzed and classified. When neither study indicates abnormality, angiography is not required, as SDH is unlikely. When the scintigraphic appearance is characteristic of SDH, angiography or surgical exploration is mandatory, since SDH is probably present. When the scintigraphic findings are consistent with but not typical of SDH, the study remains useful as a screening procedure, but the decision to proceed with angiography is based primarily on the neurological course. (auth)

1075 VASCULAR DISPLACEMENT DIAGNOSED BY CEREBRAL RADIONUCLIDE ANGIOGRAPHY. Maynard, W. P.; Mishin, F. S. (Charles R. Drew Postgraduate Medical School, Los Angeles). Radiology; 117: No. 2, 361-364(Nov 1975).

Findings are reviewed in twelve patients who had both contrast and /sup 99m/Tc-pertechnetate radionuclide cerebral angiograms interpreted as showing displacement of the anterior or middle cerebral arteries on either study. The radionuclide angiogram detected 3 of 8 displacements of the anterior cerebral artery and 9 of 10 displacements of the middle cerebral artery. In two cases the radionuclide study suggested displacement of the middle cerebral artery when in fact it was occluded in one and normal in the other. Radionuclide angiographic detection of major cerebral artery displacement provides valuable interpretative data, particularly when the middle cerebral artery is involved. (auth)

1076 RADIONUCLIDE UPTAKE STUDIES OF BONE: A QUANTITATIVE METHOD OF EVALUATING THE RESPONSE OF PATIENTS WITH PAGET'S DISEASE TO DIPHOSPHONATE THERAPY. Goldman, A. B.; Braunstein, P.; Wilkinson, D.; Kammerman, S. (New York Univ.). Radiology; 117: No. 2, 365-369(Nov 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

In order to evaluate and quantitate the therapeutic efficacy of disodium etridonate (EHDP) in the treatment of Paget's disease, a prospective double-blind study was instituted. Subjects received either placebo, low-dose EHDP, or high-dose EHDP and were evaluated prior to therapy and 6 months later. Bone scans were performed with /sup 99m/Tc or ^{18}F and radioisotopic uptake studies were conducted. The results were correlated with clinical improvement, biochemical parameters, and radiographic skeletal surveys, and indicate that the radioisotopic uptake studies are both a sensitive and reproducible means of evaluating the degree of response to EHDP. (auth)

1077 RETAINED GASTRIC ANTRUM: A CASE REPORT. Dunlap, J. A. Jr.; McLane, R. C.; Roper, T. J. (Greenville Memorial Hospital, SC). Radiology; 117: No. 2, 371-372(Nov 1975).

A case of retained gastric antrum, confirmed by radiographic and /sup 99m/Tc-pertechnetate scintiscan techniques, is presented. Any patient with chronic, recurrent peptic ulceration following subtotal gastric resection and gastrojejunostomy should have an adequate upper gastrointestinal series with filling of the afferent loop. In addition, intravenous injection of /sup 99m/Tc pertechnetate is a noninvasive technique which aids in the identification of a retained gastric antrum. (auth)

1078 ABSORPTION DISTRIBUTION AND EXCRETION OF ^{14}C-ANTI-TUMOR NEW MUSTARD (^{14}C-AT-581) IN ANIMALS. Chang, S. Y.; Lo, H. F.; Hsu, P. (Shanghai Inst. of Pharmacology). Chung Hua I Hsueh Tsa Chih; No. 2, 121-123(20 Feb 1975). (In Chinese).

Carbon-14-labeled AT-581 was injected intravenously in small white mice to study the absorption, distribution, and excretion of the drug. Preliminary results indicate that the activity of ^{14}C is in the order of bladder (including bile) kidney, blood plasma, tumor, lung, liver, and spleen. At 24 hours after injection, the radioactive intensity in the bladder and kidney is about half the intensity 1 hour after injection; the absolute value remains the highest, however. This is perhaps due to the fact that the drug is excreted through the bladder and the kidney. A study perhaps should be conducted to see if the drug is more effective in treating tumors of the bladder and kidney. It should be pointed out that within 24 hours the radioactive intensity in the chest shows a tendency to increase. Toxicity to this organ should be considered if it is used for treatment. The chemical contents and the pharmacological theory of this drug are briefly discussed. (auth)

1079 UTILIZATION OF ELECTRONIC COMPUTERS FOR BONE DENSITY MEASUREMENTS WITH IODINE 125 PROFILE SCANNER. Reiners, C. Wuerzburg, Ger.; Wuerzburg Univ. (1974). 62p. (In German). INIS.

Thesis.

The utilization of electronic computers in the determination of the mineral content in bone with the ^{125}I profile scanner offers many advantages. The computer considerably lessens intensive work of routine evaluation. It enables the direct calculation of the attenuation coefficients. This means a greater accuracy and correctness of the results, as compared with the former "graphical" method. The approximations are eliminated and reference errors are avoided. (GE)

1080 COMPARATIVE AUTORADIOGRAPHY OF IRRADIATED ANIMAL TUMOR FOLLOWING IN VITRO/IN VIVO LABELLING WITH ^{3}H THYMIDINE. Kleinschmidt, J. Muenster, Ger.; Muenster Univ. (1972). 28p. (In German). INIS.

Thesis.

In the course of a working program for the radiobiological corroboration of radiological tumor therapy, the effect of X-ray irradiation on the adenocarcinoma of the breast of C3H mice was investigated by means of ^{3}H-thymidine labelling. The purpose was to test whether the radiation-induced proliferation disturbance can also be shown by in-vitro labelling of the tumor tissue and whether the time slope can be traced. In-vivo and in-vitro labelling exhibited approximately the same labelling index prior to irradiation and, to a large extent, the same drop and rise of the proliferative activity. Certain deviations were observed, especially in the recovery phase. The results suggest that the tracing of the radiation reaction of human tumors by in-vitro labelling might be promising. (GE)

1081 EFFECT OF THEOPHYLLINE ON THE LABELLING OF INTRACELLULAR MYOCARDIAL CALCIUM WITH ^{45}Ca. Sausen, F. H. Mainz; Univ. Mainz (1973). 34p. (In German). INIS.

Thesis.

The effect of theophylline of varying concentration on the labelling of intracellular myocardial calcium was investigated by isotope tests with radioactively labelled Ca(^{45}Ca) in isolated, electrically stimulated left auricles of guinea pigs. The preparates were incubated in a ^{45}Ca solution for 60 minutes, and activity uptake and intracellular Ca concentration were determined. Intercellular Ca was found to be ^{45}Ca-labelled by about 36% theophylline in "therapeutical" concentration (5×10^{-4} g/ml). "Toxic" theophylline concentrations, too, lead to a significantly higher absorption of ^{45}Ca. The interchangeable intracellular Ca fraction increased by 11.7% and 10.3% as compared to the untreated preparates. Findings are discussed with regard to earlier investigations on the influence of methylxanthines on the Ca metabolism of the heart. (auth)

1082 SLOW GROWTH RATE OF A DEEP-SEA CLAM DETERMINED BY ^{228}Ra CHRONOLOGY. Turekian, K. K. (Yale Univ., New Haven); Cochran, J. K.; Kharkar, D. P.; Cerrato, R. M.; Vaisnys, J. R.; Sanders, H. L.; Grassle, J. F.; Allen, J. A. (Yale Univ., New Haven). Proc. Natl. Acad. Sci. U. S. A.; 72: No. 7, 2829-2832(Jul 1975).

The age of a deep-sea clam, Tindaria callistiformis, from 3800 m depth has been determined by ^{228}Ra (6.7 year half-life) chronology of separated size fractions of a captured population. A length of 8.4 mm is attained in about 100 years. Shells of this size fraction show about 190 regularly spaced bands, indicating that the growth feature may be an annual one. (auth)

1083 BONE MINERAL CONTENT DETERMINED BY FUNCTIONAL IMAGING. DePuey, E. G.; Thompson, W. L.; Alagarsamy, V.; Burdine, J. A. (Baylor College, Houston, TX). J. Nucl. Med.; 16: No. 10, 891-895(Oct 1975).

Quantitation of bone mineral by photon absorptiometry is a simple and accurate method for determining changes in bone volume and mineral content in serial studies. An extension of the scintillation camera method for studying such changes in the calcaneous is described. This technique is applicable to large areas of bone, thereby minimizing the effect of repositioning errors. Using a 40-mCi ^{241}Am sheet source, a 2.1 percent reproducibility in bone phantoms and a 2.4 percent reproducibility in normal patients was achieved. Several case studies are presented to illustrate sensitivity and clinical application of the method. Although bone mineral determinations are now performed in a limited number of health care facilities, the scintillation camera method described in this report could increase the availability of these determinations significantly. (auth)

1084 BINDING OF ^{125}I-HUMAN GROWTH HORMONE TO SPECIFIC RECEPTORS IN HUMAN CULTURED LYMPHOCYTES. Lesniak, M. A.; Gorden, P.; Roth, J.; Gavin, J. R, III. (National Institutes of Health, Bethesda, MD). J. Biol. Chem.; 249: No. 6, 1661-1667(25 Mar 1974).

The interaction of human growth hormone with human lymphocytes from an established culture (IM-9) was studied using ^{125}I-human growth hormone. The binding of ^{125}I-human growth hormone was rapid; with human growth hormone at 0.1 nM a steady state was observed in 90 min at 30°. Bound labeled human growth hormone was dissociated rapidly by addition of excess unlabeled human growth hormone. Binding of ^{125}I-human growth hormone to cultured lymphocytes was relatively insensitive to alterations in the pH and in the concentrations of Ca^{2+}, Mg^{2+}, or EDTA. At 80° there was very little degradation of labeled human growth hormone or of the specific receptor sites. Tryptic digestion destroyed the capacity of cells to bind human growth hormone. The IM-9 cells bound all human growth hormone preparations but not unrelated hormones or nonprimate growth hormones. The binding of ^{125}I-human growth hormone was inhibited 10 to 14 percent with 1 to 2 ng per ml of unlabeled human growth hormone and 50 percent with 30 to 40 ng per ml, well within the range of hormone concentrations in vivo. Analysis of steady state data revealed a single order of binding sites with an affinity constant of 1.3×10^9 M^{-1} and about 4000 binding sites per cell. Numerous human growth hormone preparations were assayed by use of this receptor system as well as by immunoassay and by bioassay in vivo. The potencies of the human growth hormone preparations determined by the radioreceptor assay correlated more closely with the bioassay than with the radioimmunoassay. (auth)

MATERIALS

1085 (COO--623-207) SOLID STATE PHYSICS PROGRAM. Final Report. (Case Western Reserve Univ., Cleveland, Ohio (USA)). Jun 1975. Contract AT(11-1)-623. 33p. Dep. NTIS $4.75.

During the 17 year period of this research, experimental and theoretical investigations were completed in many aspects of cohesive properties of metals and alloys and dielectric properties of various crystals and glasses together with the temperature and pressure derivatives of both properties. Studies of the magnetization and magnetic anisotropy indicate superparamagnetism is common in oligatomic condensed films and any decreased magnetic moment must be associated with surface atoms. Large intrinsic stresses are associated with growth morphology and impurities at grain boundaries. Transport properties in normal metals have been investigated theoretically. A number of basic theorems for disordered systems were derived. (204 references) (auth)

Ceramics and Cermets

Refer also to abstracts 158, 1174, 1188, 1189, 1271–1273, 1276, 1284, 1287, 1321, 1331, 1338, 1352, 1383, 1811, 2288, 2487, and 2496.

1086 (AD/A-004828) INJECTION LUMINESCENT STUDIES IN CADMIUM SULFIDE (CdS) JUNCTION DEVICES. Final Report, 1 January 1972–31 December 1973. Chernow, F. (Colorado Univ., Boulder (USA). Dept. of Electrical Engineering). Sep 1974. 69p.

The role of implanted Bi in type conversion of Cds has been explored and clarified. Unimplanted, n-type, vapor phase grown CdS platelets were studied in a search for substrates with electrical and optical properties suitable for efficient LED's; growth of these substrates has been achieved, but controlled, high yield has not been attained. Radiation damage incurred by heavy ion implants of CdS was studied; new methods for measuring the density of non-radiative recombination centers were found and applied to CdS, but methods of post-treatment to remove these centers were not found. Methods of improving efficiency through increasing the thickness of the implanted p layer were studied. Range measurements indicate that the p layer thickness can be doubled by employing channeling. A new range theory based on combined single and multistream diffusion was developed to explain the profile data. These range studies also led to a new technique for measuring stopping power of probe ions used in Rutherford backscattering. (GRA)

1087 (BNWL-SA-5333) ALPHA RADIATION DAMAGE IN THE ACTINIDE DIOXIDES. Turcotte, R. P. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 8p. (CONF-750915-21). Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden-Baden, F.R. Germany (10 Sep 1975).

Radiation damage in the actinide dioxides is examined with respect to point defect ingrowth and annealing behavior. In alpha decay, the alpha particle is shown to contribute 19 percent of the total damage. Experimental results for alpha bombardment, alpha decay, and fission are compared to displacement theory results. A large difference for ingrowth of damage is demonstrated, but isochronal annealing curves are similar for all three damage types. (auth)

1088 (BNWL-SA-5334) CALIFORNIUM OXYGEN SYSTEM FOR 1.50 LESS THAN O/Cf LESS THAN 1.72. Turcotte, R. P.; Haire, R. G. (Battelle Pacific Northwest Labs., Richland, Wash. (USA); Oak Ridge National Lab., Tenn. (USA)). 1975. 10p. (CONF-750913--14). Dep. NTIS $4.00.

From fourth international transplutonium elements symposium; Baden-Baden, F. R. Germany (13 Sep 1975).

The californium-oxygen system was studied as a function of temperature, oxygen pressure, and stoichiometry by manometric and x-ray diffraction methods. The results establish rhombohedral Cf_7O_{12} as the stable compound obtained by heating Cf_2O_3 in air. The isobaric oxidation-reduction cycles Cf_2O_3 yields Cf_7O_{12} yields Cf_2O_3, observed in constant rate of heating (cooling) experiments, occur with large hysteresis. A close parallel to other fluorite related lanthanide and actinide oxide systems is established. (auth)

1089 (CONF-750850--1) THERMAL CONDUCTIVITY OF IRRADIATED, ADDITIVELY-COLORED, AND DEFORMED MgO. Hartmann, J. B.; Weinstock, H.; Chen, Y. (Illinois Inst. of Tech., Chicago (USA). Dept. of Physics; Oak Ridge National Lab., Tenn. (USA)). 1974. 9p. Dep. NTIS $4.00.

From second international conference on phonon scattering in solids; Nottingham, UK (27 Aug 1975).

Low-temperature (0.1-100^{0}K) thermal conductivity measurements were made on neutron-irradiated, electron-irradiated, additively colored, and deformed MgO. Resonance scattering of phonons occurs at 15 to 20^{0}K and is associated with anion vacancies. A resonance also occurs at 1^{0}K in neutron-irradiated samples which is attributed to defect aggregates. (DLC)

1090 (INIS-mf-1703, pp 64-77) GAS RELEASE AND STRUCTURAL CHANGES IN UO_2 UNDER IRRADIATION. Samsonov, B. V.; Sidorov, V. V.; Spiridonov, Yu. G.; Sulaberidze, V. Sh.; Tsykanov, V. A. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

Experimental results are presented on the kinetics of gas evolution and the structural changes in uranium dioxide during irradiation. The main regularities and a number of details of the process are presented. A method is proposed for calculating the yield of gaseous fission products in clad fuel elements containing uranium dioxide as the fuel. (tr-auth)

1091 (IS-T-678) EFFECTS OF TEMPERATURE AND MICROSTRUCTURE ON THE ELASTIC PROPERTIES OF SELECTED Eu_2O_3-HfO_2 COMPOSITIONS. Suchomel, R. R. (Ames Lab., Iowa (USA)). Oct 1975. Contract W-7405-eng-82. 101p. Dep. NTIS $8.25.

Thesis.

Europium oxide is presently being tested for use as the control material in future nuclear power reactors. Elastic properties of europia and selected europia-rich compositions of the europia-hafnia system were investigated. The sonic technique was employed to measure elastic moduli from room temperature to 1500^{0}C. Sintered monoclinic europia specimens were found to have uncommonly low room temperature moduli values and to exhibit hysteresis between heating and cooling curves because of the presence of microcracks caused by thermal expansion anisotropy. Fine grained hot pressed europia as well as sintered specimens that contained at least 6 mole percent hafnia did not exhibit these characteristics. Photomicrographs revealed that grain growth suppression was produced by and related to the amount of hafnia introduced. Hysteresis loops in the moduli versus temperature measurements were exhibited only by those specimens for which the average grain size was in excess of a critical value of 8 mu m. Dilatometer measurements indicated that thermal expansion was relatively constant over the compositional range of interest. (auth)

1092 (IS-T-700) DEUTERON NUCLEAR MAGNETIC RESONANCE INVESTIGATION OF $LaNi_5D$/sub x/ COMPOUNDS. Nelson, S. O. (Ames Lab., Iowa (USA)). Oct 1975. Contract W-7405-eng-82. 65p. Dep. NTIS $6.25.

Thesis.

The ^{2}D quadrupole interaction was observable in all the samples of $LaNi_5D$/sub x/ up to a critical temperature T/sub c/ at which the intensity of the quadrupole interaction spectrum disappeared and only a narrow unsplit line remained. The critical temperatures were 360^{0}K for the x equals 3.6 sample and 380^{0}K for the x equals 5.7, 6.7 samples. Based on preliminary electric field gradient (EFG) calculations, it appears likely that several quadrupole interactions are being observed from inequivalent deuterium sites in the lattice. In the temperature range T greater than or equal to 300^{0}K, it appears that diffusional averaging is not entirely isotropic and that the deuterium still occupies certain interstitial sites preferentially. The temperature dependence of the ^{2}D characteristic quadrupole frequency (nu/sub Q/) and the disappearance of the ^{2}D quadrupole interaction signal were found to be compatible with desorption of the deuterium from the $LaNi_5$ lattice with increasing temperature. Spectra obtained from D_2 gas samples under various experimental conditions (pure gas, gas above $LaNi_5D_{6.7}$, and gas within or on $LaNi_5$ at 77^{0}K) may provide evidence for the identification of the solid-solution alpha-phase or for the existence of an adsorbed deuterium surface film on the $LaNi_5$. In addition, the spectra suggest that at 77^{0}K rapid deuterium exchange between the gas and surface contributes to spin-lattice relaxation and, hence, to broadening of the NMR resonance. (auth)

1093 (JINR-P14-8997) STUDY OF THE RELATIVE CHARGE CHANGE OF HYDROGEN ATOM IN TRANSITION METAL HYDRIDES. Kost, M. E.; Krumshtein, Z. V.; Mikheeva, V. I.;

Padurets, L. N.; Petrukhin, V. I.; Suvorov, V. M.; Chertkov, A. A.; Yutlandov, I. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1975. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The chemical bonds of hydrogen in transition metal hydrides were studied by investigating the peculiarities of negative pion capture in hydrogen. The pion capture probability is approximated by expression (1) where the coefficient α implies the chemical structure properties of the molecule. As for protonized hydrogen $\alpha \rightarrow O^{3/}$ this method makes it possible to estimate the relative change of the electron density of the H-atom in metal hydrides within a period of the periodic system. The electron density of hydrogen atoms becomes lower passing from the hydrides of the elements of groups I and II to those of groups IV and V. For metallic hydride pairs $TiH_{1.65}-TiH_2$, $VH_{0.78}-VH_{1.6}$ and $NbH_{0.95}-NbH_{1.7}$ the character of Me-H bond is not changed essentially with increasing the hydrogen content. At the transition from MeH_2 to MeH_3 for Y, La, and Ce the coefficient α is increased. The measured points of α vs at. number are located along two straight lines for ionic hydrides along line I and for metallic ones along line II. This fact suggests the conclusion that the electron density in the hydrogen atoms is larger in ionic hydrides than in metallic hydrides. The values of trihydride/dihydride electron density ratio, $\rho_3/\rho_2 = ZH_3/ZH_2$ show that YH_3 and LaH_3 are ionic hydrides while ErH_3, ErH_2, YH_2, and LaH_2 are metallic. (auth)

1094 (JUL-1194) INVESTIGATIONS OF STRUCTURE AND TEXTURE DEPENDENT SURFACE REACTIONS BETWEEN PYROCARBON AND OXYGEN AT ROOM TEMPERATURE. Wolfrum, E. A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). May 1975. 126p. (In German). Dep. NTIS (US Sales Only) $9.50.

Thesis.

Within the scope of general investigations on material properties of pyrocarbon coating layers on coated fuel particles, the chemical behavior of the pyrocarbon surface and the processes occurring on them on a reaction with oxygen or atmosphere at room temperature were subjected to investigations. The study was conducted to investigate the behavior of the reaction as a function of surface properties of the solid and to develop, on the basis of these results, methods for a chemical characterization of pyrocarbon coating layers. The hydrogen peroxide concentration produced on the surface could be traced by fluorescence spectrometry in connection with the autoxidation reaction of N,N-dimethyl formamide. The concentration is proportional to the number of unpaired electrons of the pyrocarbon coating layers. The simultaneously produced basic surface oxides are a function of the disordered material of high inner surface. On this basis, a method has been developed by which the concentration of the tangled material in pyrocarbon coating layers can be determined quantitatively. (auth)

1095 (LA-6012) NEW METHOD FOR COATING MICROSPHERES WITH ZIRCONIUM CARBIDE AND ZIRCONIUM CARBIDE–CARBON GRADED COATS. Hollabaugh, C. M.; Reiswig, R. D.; Wagner, P.; Wahman, L. A.; White, R. W. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. Contract W-7405-eng-36. 6p. Dep. NTIS $4.00.

A new method for the chemical vapor deposition of ZrC and C–ZrC alloys has been developed. This process has been applied to the fabrication of coated particle nuclear fuels of the type used in the large High-Temperature Gas-Cooled Reactor. A powder feeder is used to supply $ZrCl_4$ to the fluidized bed coating furnace where it undergoes reaction with a hydrocarbon to form ZrC. Quantitative metering of the $ZrCl_4$ makes it possible to control the deposition of the ZrC and the codeposition of the C–ZrC alloys on the fuel particles. Examples of both types of coats made using the described technique are discussed and illustrated. (auth)

1096 (N-75-21384) MAGNETIZATION AND MAGNETIC SUSCEPTIBILITY OF DyH_3. Flood, D. J. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). 1974. 11p. (NASA-TM-X-71698; E-8303). NTIS $3.25.

The magnetization and differential magnetic susceptibility of powdered samples of DyH_3 have been measured at 4.2^0K in applied magnetic fields ranging to 9 Teslas. The differential magnetic susceptibility has also been studied in zero applied field as a function of temperature. The magnetization data are described by an equation of the form M equals $[aB/(1 + bB)] + cB$. The ratio a/b is a measure of the saturation magnetization and gives an effective moment of 5.12 Bohr magnetons per ion. The zero field susceptibility exhibits a maximum at T equals 3.45^0K, and an inflection point near 2.85^0K. The susceptibility at 4.2^0K has a 1/B squared dependence on the applied magnetic field for B approximately greater than 0.3 Teslas. (auth)

1097 (ORO-4721-4) TRITIUM DIFFUSION IN NONMETALLIC SOLIDS OF INTEREST FOR FUSION REACTORS. Annual Progress Report, June 1, 1974–August 1, 1975. Elleman, T. (North Carolina State Univ., Raleigh (USA). Dept. of Nuclear Engineering). 1975. 42p. Dep. NTIS $5.25.

Tritium diffusion coefficients in selected metal oxides and carbides plus pyrolytic carbon have been measured by injecting tritium into specimens and measuring the time rate of tritium release during isothermal annealing. Release results were generally consistent with classical diffusion solutions and yielded diffusion coefficients characterized by a single-valued activation energy over the temperature range of measurement. The pyrolytic carbon results were unique in that tritium release was apparently controlled by surface desorption or exchange rather than diffusion. Measured diffusion coefficients were considerably lower than the literature values for metals at comparable temperatures, which suggests that metal oxides, carbides, or nitrides may be useful as tritium barriers in fusion systems. (auth)

1098 (RDT-M-1-23T(9-75)) 2-1/4-PERCENT-CHROMIUM, 1-PERCENT-MOLYBDENUM ALLOY BARE WELDING RODS AND ELECTRODES. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Reactor Research and Development). Sep 1975. 7p. RSO.

A standard prescribing requirements for $2^1/_4$ percent Cr–1 percent Mo bare welding rods and electrodes for nuclear and associated applications is presented. (J RD)

1099 (RISO-M-1801) FAILURE AND ELASTICITY OF CONCRETE. Ottosen, N. S. (Danish Atomic Energy Commission, Risoe. Research Establishment). 21 Jul 1975. 81p. Dep. NTIS (US Sales Only) $7.25.

A four-parameter failure criterion is proposed. It has all the required properties concerning smoothness including convexity, symmetry, and curved meridians, and gives a close estimate of experimental failure stresses for complete general stress states. General criteria for failure mode and elastic limits are proposed and compared with experimental results. Some of the most important published failure tests and failure criteria are discussed. (auth)

1100 (SAND--74-7006) STUDIES OF TANTALUM NITRIDE THIN FILM RESISTORS. Langley, R. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 23p. (CONF-750949--5). Dep. NTIS $4.25.

From international conference on ion beam surface layer analysis; Karlsruhe, F. R. Germany (15 Sep 1975).

Backscattering of 2-MeV He ions was used to correlate the electrical properties of sputtered TaN/sub x/ thin-film resistors with their N content. The properties measured were sheet resistance, differential Seebeck potential (DSP), thermal coefficient of resistance (TCR), and stability. Resistivity and DSP are linearly dependent on N content for N/Ta ratios of 0.25 to 0.55. TCR decreases sharply below N/Ta equals 0.35 and is relatively constant from 0.35 to 0.55. Stability is independent of N content. (DLC)

1101 (UCRL-76822(Rev.1)) 1.06 mu m 150 psec LASER DAMAGE STUDY OF DIAMOND TURNED, DIAMOND TURNED/POLISHED AND POLISHED METAL MIRRORS. Saito, T. T.; Milam, D.; Baker, P.; Murphy, G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Jul 1975. 33p. (CONF-750730-2). Dep. NTIS $4.75.

From symposium on damage in laser materials; Boulder, Colorado, USA (30 Jul 1975).

Using a well characterized 1.06 mu m 150 ps glass laser pulse the damage characteristics for diamond turned, diamond turned/polished, and polished copper and silver mirrors less than 5 cm diameter were studied. Although most samples were tested with a normal angle of incidence, some were tested at 45^0 with different linear polarization showing an increase in damage threshold for S polarization. Different damage mechanisms observed will be discussed. Laser damage is related to residual surface influences of the fabrication process. First attempts to polish diamond turned surfaces resulted in a significant decrease in laser damage threshold. The importance of including the heat of fusion in the one dimensional heat analysis of the theoretical damage threshold and how close the samples came to the theoretical damage threshold is discussed. (auth)

1102 ON POLYMORPHIC (NORMAL, MARTENSITE) TRANSFORMATIONS. Ehstrin, Eh. I. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Chernoj Metallurgii, Moscow (USSR). Inst. Metallovedeniya i Fiziki Metallov). Fiz. Metal. Metalloved.; 37: No. 6, 1249-1255(Jun 1974). (In Russian).

For English translation see the journal Phys. Met. Metallogr.

Special features of polymorphic transformations, in particular, the significant hysteresis of such transformations at low tem-

peratures, and the thermodynamic potential under pressure are discussed. Equations are given for estimating the energy of the state of steepest descent and the volume effect of the transformation. Values of the elastic energy of this state are presented for a number of transformations (Ti, Zr, Fe, KCl, RbI). The kinetics of polymorphic transformation were determined for the competing process of reconstruction of the lattice and relaxation. This is due to the noncorrespondence between theoretically calculated data and experimentally observed rates of normal polymorphic transformations. (tr-auth)

1103 SINTERIZATION IN A REDUCING ATMOSPHERE AND RECTIFICATION OF URANIUM DIOXIDE PELLETS IN THE ATOMIC ENERGY INSTITUTE OF SAO PAULO. Freitas, C. T. de; Souza Santos, T. D. de (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Metalurgia Nuclear). Ceramica (Sao Paulo); 18: No. 71, 345-352(Sep 1972). (In Portuguese).

Experiments are described of sinterization in a reducing atmosphere and rectification of high-density UO_2 pellets, produced in the Atomic Energy Institute of Sao Paulo. The work aims at the production of uranium pellets satisfying specifications currently adopted in the exterior for power reactor nuclear fuel elements. Uranium oxides resulting from diverse chemical processes developed at the Atomic Energy Institute, are employed. The influence of different types of agglomerates in the cold compacting of UO_2 powders is discussed. All the pellets, after elimination of the agglomerate in an inert atmosphere furnace, were sintered in a molybdenum electric resistance furnace, in a reducing atmosphere, at a temperature of 1625°C for 4 hours. The pellets had their cylindrical surfaces adjusted in a centerless rectifier of national fabrication. For the study of microstructure, an optical microscope as well as an electron sweep microscope was used. The results obtained assure that the Nuclear Metallurgy Division of the Atomic Energy Commission possesses the technology necessary for production of UO_2 pellets adequate for use as fuel elements of research or power reactor. (INIS)

1104 ON THE BEHAVIOR OF OXIDES, NITRIDES AND CARBIDES IN SAMARIUM. Spasskaya, A. A.; Agapov, R. A.; Pikunov, M. V.; Fomin, B. A. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 19-25 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

Two types of oxide inclusions in samarium were studied, one of which was the sesquioxide of the high-temperature modification. The type and nature of the distribution of nitride and carbide inclusions were determined metallographically. (tr-auth)

1105 PHASE COMPOSITION AND PHASE DIAGRAMS OF THE V_2O_5-RbV_2O_5 SYSTEM. Surat, L. L.; Volkov, V. L.; Fotiev, A. A. (AN SSSR, Sverdlovsk. Inst. Khimii). Zh. Neorg. Khim.; 19: No. 10, 2875-2877(Oct 1974). (In Russian).

For English translation see the journal Russ. J. Inorg. Chem.

X-ray and differential thermal analysis methods were used to study the phase composition and diagrams of state of the V_2O_5-RbV_2O_5 system. The thermal behavior of rubidium vanadium oxide was studied in an atmosphere of air. (tr-auth)

1106 INVESTIGATION OF Nb_2O_5 SOLUBILITY IN MOLTEN DIPHOSPHATE-FLUORIDE SYSTEMS. Grigorenko, F. F.; Slobodyanik, N. S.; Nagornyi, P. G.; Fedoruk, T. I. (Kievskij Gosudarstvennyj Univ. (Ukrainian SSR). Kafedra Neorganicheskoj Khimii). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 10, 1459-1462(1974). (In Russian).

An isothermal saturation method was used to study the solubility of Nb_2O_5 in the molten systems $Me_4P_2O_7$-MeF, where Me = Li, Na, or K. The temperature dependence of Nb_2O_5 solubility in $Na_4P_2O_7$-NaF and $K_2P_2O_7$-KF eutectics was studied. X-ray phase analysis of solid precipitates in the systems studied showed that they consist of meta and ortho niobates of the alkali metals. (tr-auth)

1107 EROSION RESISTANCE OF ZIRCONIUM-NIOBIUM CARBIDE ALLOYS IN THE HOMOGENEITY REGION. Samsonov, G. V.; Verkhoturov, A. D.; Naumenko, V. Ya.; Klkalova, L. N. Elektron. Obrab. Mater.; No. 4, 10-11(1974). (In Russian).

For English translation see the journal Appl. Electr. Phenom.

A study is presented on the intensity of electroerosion and also on the microhardness of zirconium and niobium carbide alloys in the region of homogeneity. A correlation is found of a concentration change in the intensity of electroerosion to the microhardness, and also the external change in these values for carbide phases which are more defective in carbon. It is concluded that the Me(IV)-Me(V) interaction plays a dominant role in the total binding energy during formation of solid carbide solutions. (auth)

1108 OXIDATION OF ZIRCONIUM CARBIDE FOLLOWING SHOCK WAVE ACTION. Breusov, O. N.; Tatsij, V. F. Zh. Neorg. Khim.; 19: No. 11, 2928-2931(Nov 1974). (In Russian).

For English translation see the journal Russ. J. Inorg. Chem.

A study was made of the oxidation of ZrC samples subjected to the action of shock waves having an amplitude in the interval of 160 to 350 kbar. The shock wave treatment noticeably increases the rate of oxidation. On oxidizing ZrC a cubic zirconium dioxide is formed with lattice parameter a = 5.10 ± 0.02 Å. (tr-INIS)

1109 PREPARATION OF PURE TERBIUM-OXIDE BY CRAIG DISTRIBUTION. Rossmanith, K. (Vienna Univ. (Austria). Inst. fuer Anorganische Chemie). Monatsh. Chem.; 105: No. 5, 1025-1029(Sep 1974). (In German).

In the preparative Craig distribution of Tb-nitrate between HNO_3 and tributyl phosphate the method of lower phase withdrawal using 12m-HNO_3 was shown to be far superior to upper phase withdrawal; the superiority becomes even more marked as the atomic number of the rare earth element increases. From mixtures enriched in Tb by oxidation melting, Tb_4O_7 of more than 99% purity was separated, from which Tb_4O_7 of over 99.9% purity was obtained 87% yield using up to 960 effective stages. (auth)

1110 COMPARATIVE EVALUATION OF EFFICIENCY OF COATING FORMATION PROCESSES. Kuznetsov, G. D.; Babad-Zakhyrapin, A. A.; Lysenko, L. T.; Galakhov, V. V. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 5, 146-149(1974). (In Russian).

For English translation of selected articles see the journal Stal USSR.

A look is taken at the process of coating formation by the decomposition of volatile compounds in a low-pressure atmosphere and under glow-discharge conditions. The concept of a coefficient to describe the efficiency of layer growth is introduced. Comparative values of this coefficient are presented for different methods with the decomposition of niobium pentachloride as an example. The highest coefficient for the efficiency is obtained in a glow-discharge. A laboratory unit is described for carrying out comparative studies of coating formation in a low-pressure atmosphere and in a glow discharge. (tr-auth)

1111 CRYSTAL STRUCTURE OF $Cd_x Hg_{1-x} Te$ SOLID SOLUTIONS PREPARED FROM MELT. Bojnykh, N. M.; Sokolov, A. M.; Indenbaum, G. V.; Vanyukov, A. V. Izv. Akad. Nauk SSSR, Metal.; No. 5, 240-242(Sep 1974). (In Russian).

For English translation see the journal Russ. Metall.

Etching agents are proposed for developing dislocations on planes of different orientation in solid-solution crystals $Cd_{0.2-0.24}Hg_{0.8-0.76}Te$. By means of etching a study was made of the density and distribution of dislocations, and also of the precipitation of a second phase in crystals grown from a melt in quartz ampules by the Bridgeman–Stokbarger method. Measurements of the disorientation of sections were carried out on a two-crystal, x-ray spectrometer. The substructure was determined as a function of crystallization rate and ampule diameter. (tr-SJR)

1112 URANIUM-SULFUR SYSTEM. Ehllert, G. V.; Sevast'yanov, V. G.; Slovyanskikh, V. K. (AN SSSR, Moscow. Inst. Obshchej i Neorganicheskoj Khimii). Zh. Neorg. Khim.; 19: No. 11, 3107-3111(Nov 1974). (In Russian).

For English translation see the journal Russ. J. Inorg. Chem.

By the methods of differential thermal analysis, and x ray, chemical, and microstructural analyses a study was carried out on the high-temperature part of the uranium–sulfur (53.1 to 64.7 at % S) system. The microhardness of fused samples was measured. A phase diagram was constructed from the data. (tr-auth)

1113 DETERMINATION OF IONIC COMPONENT OF COMMON ELECTRIC CONDUCTIVITY FOR NON-STOICHIOMETRIC COMPOUNDS. Opara, B. K.; Pavlov, Yu. A.: Polyakov, V. P.; Ploshkin, V. V.; Fokin, M. N. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 9, 26-30 (1974). (In Russian).

For English translation see the journal Stal USSR.

Two techniques are proposed for determining the ionic component of the total electrical conductivity. Their advantages are determined as compared with the method which is ordinarily used. Under experimental conditions, polarization phenomena are absent in a cell of the type: $p'(O_2)$, Pt|MeO|Pt, $p''(O_2)$. The compounds MoO_3 and α-Nb_2O_5 were used as samples. (tr-INIS)

1114 EFFECT OF SPLAT COOLING AND AGEING ON STRUCTURE AND SOME PROPERTIES OF NIOBIUM-TUNGSTEN-ZIRCONIUM(HAFNIUM)-CARBON ALLOYS. Savitskij, E. M.; Ivanova, K. N.; Revyakin, A. V.; Glyuzitskij, B. D.; Khandarov,

P. A. (AN SSSR, Moscow. Inst. Metallurgii). Fiz. Metal. Metalloved.; 38: No. 1, 117-125(Jul 1974). (In Russian).

For English translation see the journal Phys. Met. Metallogr.

By the use of various methods including electron-microscopic and x-ray phase analysis a study was made of the effect of zirconium and hafnium (up to 4 at %), rate of quenching (5×10^6 deg per sec) and aging (up to 1400°C) on the fine structure, phase composition and microhardness of niobium–tungsten–carbon (up to 2 at % C) alloys. With very fast quenching a different effect was found for zirconium and hafnium in the formation of carbide phases. In alloys of niobium–tungsten–zirconium–carbon a metastable ϵ-phase (Nb_3C_2) is found that is not present in alloys of niobium–tungsten–hafnium–carbon. The difference in microhardness and deformation of the alloys is associated with the presence of this metastable phase. The formation of the metastable ϵ-phase depends on the affinity of the carbide-forming element and of carbon. On aging of fast-quenched alloys, dispersed monocarbides of zirconium and hafnium of the MeC type appear with a platelet or spherical form depending on the alloying element. (tr-auth)

1115 TEMPERATURE DEPENDENCE OF ELASTIC MODULI OF CUBIC CARBIDES OF Zn-Nb-C SYSTEM. Avgustinik, A. I.; Ordan'yan, S. S.; Fishchev, V. N. (Leningradskij Tekhnologicheskij Inst. (USSR)). Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 9, 1623-1627(Sep 1974). (In Russian).

For English translation see the journal Inorg. Mater.

The temperature dependencies of the elastic moduli of carbides in the Zr-Nb-C system are linear in character in the temperature interval from 300 to 1800°K. In the series of solid solutions $Zr_{1-x}Nb_xC_{0.3}$ the compositions close to equimolar have minimum temperature coefficients of elastic moduli. This behavior is probably associated with the effect of elastic deformation of the crystal lattice and with features of the electron structure of the carbide phases. For cubic carbides of the Zr-Nb-C system, calculations were made of the Gruneisen constant and the dimensionless parameter δ equal respectively to 1.4 ± 0.1 and 4.7 ± 0.2. An estimate was carried out of the thermal expansion coefficient and heat capacity of solid solutions of $Zr_{1-x}Nb_xC_{0.3}$. In this case the thermal expansion coefficients similar to the temperature coefficients of the elastic moduli have a minimum in the region of equimolar compositions. (tr-auth)

1116 INVESTIGATION INTO THE HEAT RESISTANCE AND MECHANICAL CHARACTERISTICS OF ZIRCONIUM DIOXIDE-BASE MATERIALS. Gashchenko, A. G.; Gogotsi, G. A.; Karaulov, A. G.; Rudak, I. N. (AN Ukrainskoj SSR, Kiev. Inst. Problem Prochnosti). Probl. Prochnosti; No. 6, 76-80(Jun 1974). (In Russian).

For English translation see the journal Strength. Mater.

Studies were made of a number of thermomechanical characteristics of zirconium dioxide-base materials as a function of the degree of stabilization of these materials by yttrium oxide. From the point of view of the mechanics of rupture an analysis was made of the change in strength characteristics and thermal stability of this class of materials, and also a look was taken at the effect of a change of the tendency to microcracking in the structure on the properties of the materials. (tr-auth)

1117 ENTHALPY OF FORMATION OF NICKEL MELTS CONTAINING BORON. Esin, Yu. O.; Baev, V. M.; Gel'd, P. V.; Petrushevskij, M. S. Izv. Akad. Nauk SSSR, Metal.; No. 4, 73-76(Jul 1974). (In Russian).

For English translation see the journal Russ. Metall.

A study was made of the concentration dependence of the enthalpy of formation of liquid nickel alloys containing boron (zero to 52 at % B) at 1838°K. Use was made of a method of directly calculating the partial molar enthalpies of dissolution. Relative changes of the temperature per gram-atom of dissolved component were determined experimentally. The dependence of this value on the composition was first used to determine the partial molar enthalpies of dissolution of boron and nickel, from which then the integral molar enthalpies of formation of the melt were calculated. The values of the enthalpies of formation that were obtained indicate a rather strong, interparticle interaction of the components in nickel alloys containing boron. (tr-auth)

1118 PROCESS FOR THE PRODUCTION OF NUCLEAR FUEL FOR NUCLEAR REACTORS. Marlowe, M. O. (to General Electric Co., Schenectady, N. Y. (USA)). Swiss Patent Document 539924/D/. 14 Sep 1973. 4p. (In German).

A procedure is described for reducing the viscosity and creep resistance, at the operating temperature of the reactor, of nuclear fuel containing at least one compound of a fissile isotope. An additive chosen from the group consisting of gadolinium oxide, cesium dioxide, yttrium oxide, W, Mo, and their mixtures is incorporated in the fuel. The quantity added (from 0.1 to 5 wt. %) is sufficient to decrease the viscosity of the fuel and allow its plastic creep. (tr-INIS)

1119 EXPERIMENTAL ESTIMATION OF LIQUID FILMS STABILITY ON NONMETALLIC INCLUSIONS. Utochkin, Yu. I.; Minaev, Yu. A.; Grigoryan, V. A. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 9, 73-75(1974). (In Russian).

For English translation see the journal Stal USSR.

A technique is proposed for experimentally estimating the stability of liquid metallic films that is based on measuring the forces that occur on discharge of deoxidation products at the phase separation boundary. With the use of the discharge of nonmetallic material from liquid nickel as an example a study was made of the possibility of forming stable films with complete wetting (ZrC, TiC), wetting with the formation of finite boundary angles (iron slag), and the absence of film formation on discharge of non-wetting materials (TiO_2, Al_2O_3, $NbCrO_3$). The formation of wetting films makes it more difficult to discharge nonmetallic particles at the interphase boundary. (tr-auth)

1120 OPTICAL EMISSION SPECTRA OF DIATOMIC METAL NITRIDES. Bates, J. K. Ann Arbor, MI; Univ. of Michigan (1975). 155p. University Microfilms Order No. 75-20,291.

Thesis (Ph. D.).

Electronic emission spectra of several diatomic metal nitrides were obtained using a microwave discharge source. A survey of metals applicable to the experimental method produced nitrides of zirconium, vanadium, niobium, tantalum, molybdenum, aluminum, and boron. The nature of the carriers has been confirmed by isotopic substitution. Results of the rotational analysis are listed for ZrN, TaN, NbN, VN, MoN, BN, AlN, and TiN. (DLC)

1121 CALCULATION OF THE THERMAL BROADENING OF THE *A* PHONONLESS LINE IN THE $^4F_{3/2} \rightarrow {}^4I_{11/2}$ BAND OF THE Nd^{3+} ION IN YTTRIUM ALUMINUM GARNET. Andriesh, I.S.; Gamurar', V.Ya.; Vylegzhanin, D.N.; Kaminskii, A.A.; Klokishner, S.I.; Perlin, Yu.E. (A. V. Shubnikov Institute of Crystallography, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 2, 162-165 (Aug 1975).

A detailed calculation is made of the width of one of the luminescence lines of Nd^{3+} in $Y_3Al_5O_{12}$ in a band corresponding to the transitions from $^4F_{3/2}$ to $^4I_{11/2}$. The calculation is made on the assumption that the phonon spectrum of the crystal is of the Debye form. Allowance is made for the influence of the noncubic nature of the crystal field and for the interaction of the 4*f* electrons with totally symmetric, tetragonal, and trigonal vibrations in the immediate environment. The results indicate that the real profile of the impurity-active vibration spectrum of the crystal has to be allowed for in considering the broadening and shift of the phononless lines of Nd^{3+} in $Y_3Al_5O_{12}$. (auth)

1122 OPTICALLY INDUCED DICHROISM IN A MAGNETIC SEMICONDUCTOR. Afanas'ev, M.M.; Zakharchenya, B.P.; Kompan, M.E.; Fleisher, V.G.; Shul'man, S.G. (A. F. Ioffe Physico-technical Institute, USSR Academy of Sciences). JETP Lett. 21: No. 8, 224-225 (20 Apr 1975).

We observed optically induced circular dichroism by pumping the ferromagnetic semiconductor europium sulfide with circularly polarized light. The observed decrease of the effect in a transverse magnetic field is well approximated by a Lorentz curve. A procedure for observing optically induced circular dichroism is presented. (auth)

1123 THE NEW HIGH-TEMPERATURE SUPERCONDUCTOR Nb_3Si. Pan, V.M.; Alekseevskii, V.P.; Popov, A.G.; Beletskii, Yu.I.; Yupko, L.M.; Yarosh, V.V. (Institute of Metal Physics, Ukrainian Academy of Sciences). JETP Lett. 21: No. 8, 228-229 (20 Apr 1975).

We have obtained for the first time the compound Nb_3Si, which has a high critical superconducting transition temperature (18.5–19 °K). The method of explosive compression was used. (auth)

1124 BAND STRUCTURES AND OPTICAL PROPERTIES OF TWO TRANSITION-METAL CARBIDES–TiC AND ZrC. Alward, J.F.; Fong, C.Y. (Department of Physics, University of California, Davis, California 95616); El-Batanouny, M.; Wooten, F. Phys. Rev. B 12: No. 4, 1105-1117 (15 Aug 1975).

The optical reflectivities of face-centered-cubic TiC and ZrC have been measured in the range $1.0 \leq \hbar\omega \leq 8.0$ eV. In addition, the electronic-energy-band structures for these compounds have been calculated using a modified empirical-pseudopotential method, and the structures in the reflectivities derived from these band structures show approximate one-to-one correspondence to the structures in the data, with agreement to the order of 0.2 eV. Prominent structures in the measured reflectivities of both compounds are identified. (auth)

1125 IMPACT IONIZATION COEFFICIENTS FOR ELECTRONS AND HOLES IN $In_{0.14}Ga_{0.86}As$. Pearsall, T.P.; Nahory, R.E.; Pollack, M.A. (Bell Telephone Laboratories, Holmdel, New Jersey 07733). Appl. Phys. Lett. 27: No. 6, 330-332 (15 Sept 1975).

We report the measurement of impact ionization rates for electrons and holes in the direct band-gap semiconductor alloy $In_{0.14}Ga_{0.86}As$. Our results show clearly that the ionization rate for holes is greater than that for electrons. The measurments were made for electric fields between 2.6×10^5 and 3.4×10^5 V cm^{-1}. In this range, the ionization coefficients can be expressed as $\alpha=\alpha_\infty \exp(-A/E)$ for electrons and $\beta=\beta_\infty \exp(-B/E)$ for holes with $\alpha_\infty=1.0\times10^6$ cm^{-1}, $A=3.6\times10^6$ V cm^{-1}, and $\beta_\infty=1.3\times10^6$ cm^{-1}, $B=2.7\times10^6$ V cm^{-1}. (auth)

1126 CHARACTERISTIC AND NONCHARACTERISTIC X RAYS PRODUCED DURING 1-MeV ARGON BOMBARDMENT OF SILICON. Lurio, A.L.; Cairns, J.A.; Ziegler, J.F. (IBM Thomas J.Watson Research Center, Yorktown Heights, New York 10598); Macek, J. Phys. Rev. A 12: No. 2, 498-501 (Aug 1975).

This work reports the first detailed examination of the noncharacteristic x-ray distribution produced during 1-MeV Ar bombardment of silicon. A crystal spectrometer was used to observe the characteristic and noncharacteristic x rays. It is shown that to within 5 eV the noncharacteristic x-ray band is continuous and tails off in the region of 1.4 keV, as required by the molecular x-ray interpretation. We have obtained the true shape of the noncharacteristic x-ray band in the energy range 675–1550 keV by using a rubidium acid phthalate crystal spectrometer calibrated for its relative efficiency. The observation of a broadened argon L line spectrum and multiple satellite line in the Si K spectrum shows that a high degree of excitation is produced in the L shells of both argon and silicon during the collision. (auth)

1127 ESTIMATE OF BAND-BENDING NEAR THE SURFACE OF BeO FROM MEASUREMENTS OF THERMALLY STIMULATED ELECTRON EMISSION. Kortov, V.S.; Slesarev, A.I. (S. M. Kirov Ural Polytechnic Institute, Sverdlovsk). Sov. Phys.—Solid State 17: No. 3, 591-591 (Mar 1975).

Using experimental data on thermionic emission from BeO in the range 273—673 °K, we calculate the band-bending as well as the concentration of surface donors. (AIP)

1128 THEORETICAL STUDIES ON THE DISPERSION OF THE NONLINEAR OPTICAL SUSCEPTIBILITIES IN GaAs, InAs, AND InSb. Fong, C.Y. (Department of Physics, University of California, Davis, California 95616); Shen, Y.R. Phys. Rev. B 12: No. 6, 2325-2335 (15 Sept 1975).

The nonlinear optical susceptibilities, $|\chi^{(2)}_{14}(2w)|$ for second-harmonic generation of GaAs, InAs, and InSb in the range $0.05 \leqslant \hbar w \leqslant 3.0$ eV are calculated from the band structure obtained by the empirical pseudopotential method. The spin-orbit interaction has been taken into account, and the transitions from the top four valence bands to the bottom four conduction bands are included in the calculation. The calculated $|\chi_{14}{}^{(2)}(2\omega)|$ with the k-dependent dipole matrix elements give much better agreement with the available experimental data than the results of constant matrix elements, which, in turn, show more structure than the ones calculated by Bell. In the case of InSb, there are two structures at 1.6 and 1.8 eV due to double resonances. A simplified model to predict structure in $|\chi_{14}{}^{(2)}(2\omega)|$ from the linear spectrum is discussed. (auth)

1129 WANNIER EXCITONS IN THE FERROMAGNETIC SEMICONDUCTORS EuO AND EuS. Mitani, T.; Koda, T. (Department of Applied Physics, Faculty of Engineering, University of Tokyo, Hongo, Bunkyo-ku, Tokyo, 113 Japan). Phys. Rev. B 12: No. 6, 2311-2317 (15 Sept 1975).

Fine structures in the thermoreflectance (TR) spectra of EuO and EuS in the ultraviolet region are ascribed for the first time to Wannier excitons in magnetic semiconductors. The characteristic temperature-induced splittings of the spectra of EuO and EuS at the ferromagnetic spin-ordering temperatures are successfully analyzed in terms of the exciton and the spin-polarization effect of the relevant one-electron bands, an s-like conduction and p-like valence bands, at the Γ point. The magnetic-spin-exchange energies, J_c and J_v, between the localized Eu-4f electrons and the band electrons, the spin-orbit interaction energy λ for the valence band, and the electron-hole spin-exchange energy Δ for the exciton are estimated. It is demonstrated that the TR measurements open a new aspect of the optical study of magnetic-semiconductor excitons which become an ideal probe for directly detecting the interaction between the localized-magnetic-spin system and the nonlocalized-Bloch-electron system in the magnetic semiconductors. (auth)

1130 INFRARED STUDY OF THE ELECTRONIC INSTABILITIES IN TANTALUM DISULFIDE AND TANTALUM DISELENIDE. Barker, A.S. Jr.; Ditzenberger, J.A.; DiSalvo, F.J. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. B 12: No. 6, 2049-2054 (15 Sept 1975).

Reflectivity spectra of the 1T form of TaS_2 and the 2H form of $TaSe_2$ have been measured over the spectral range 0.04–5.0 eV. Spectra were taken at temperatures above and below the phase transitions which have been associated with charge-density waves. Kramers-Kronig analysis shows a metallic-type conductivity at high temperatures in TaS_2. This conductivity is removed below 0.5 eV by the phase transitions but no sharp gap structure appears. In $TaSe_2$ an absorption peak appears at 0.3 eV. The spectra are related to the charge-density-wave picture of the transitions. (auth)

1131 FAILURE OF CLASSICAL FRESNEL RELATIONSHIPS IN THE EXCITON ABSORPTION REGION. Strashnikova, M.I. (Institute of Physics, Academy of Sciences of the Ukrainian SSR, Kiev). Sov. Phys.—Solid State 17: No. 3, 467-470 (Mar 1975).

The optical reflection spectra of CdS single crystals, determined at 4.2°K in the region of the A exciton band, were compared with the spectrum calculated from the Fresnel formula. In these calculations use was made of the absorption coefficients $\varkappa(\omega)$ and refractive indices $n(\omega)$ determined experimentally in refs. 1 and 2 for thin flake-like single crystals. The experimental and calculated curves differed in a fundamental way in a frequency range equal to the half-width of the exciton absorption band. This discrepancy was explained by applying the spatial dispersion theory. (auth)

1132 THERMAL PULSE DAMAGE THRESHOLDS IN CADMIUM TELLURIDE. Slattery, J.E.; Thompson, J.S.; Schroeder, J.B. (Aerospace Corporation, P.O. Box 92957, Los Angeles, California 90009). Appl. Opt. 14: No. 9, 2234-2237 (Sept 1975).

A model is presented for predicting the temperature rise in an opaque material during the absorption of a moderately short pulse of energy. Experimental verification of the model employing a pulsed ruby laser and a cadmium telluride plate is described. Two distinct damage thresholds were noted: (1) at modest energy levels plastic deformation occurred, and (2) the higher energies resulted in surface melting. (auth)

1133 FORMATION OF OXYCARBIDES OF URANIUM. Larin, A. A.; Vlasov, V. G. Zh. Prikl. Khim.; 48: No. 4, 725-729(Apr 1975). (In Russian).

Conditions for the formation of oxycarbides of uranium were studied. X-ray diffraction analysis of the intermediate products of the reaction of UO_2 and carbon in the synthesis of the oxycarbides showed that in the initial stages UC_2, U_2C_3, and UC are formed. Depending on the rate of carbothermic reduction, UO_2 is converted immediately into the carbide or oxycarbide without intermediate formation of the monoxide. When the process is slow in developing at 1500–1650° and with carbon monoxide pressure 10^{-1} to 10^{-2} mm Hg, oxycarbides or uranium form. The existence of oxycarbides of uranium over a wide region of homogeneity was shown by gravimetric, chemical, and x-ray diffraction methods. One-phase preparations of the compounds $UC_{1-x}O_x$ were identified (x was varied from 0.06 to 0.34). (JPRS)

1134 POLYMORPHISM OF VACUUM DEPOSITS OF BORON. Palatnik, L. S.; Kozma, A. A.; Nechitailo, A. A.; Fuks, M. Ya.; Tsomaya, K. P. (Kharkov Polytechnic Inst.). Sov. Phys. - Crystallogr.; 20: No. 1, 119–120(1975).

Translated from Kristallografiya; 20: No. 1, 197–198(1975).

The regularities of crystal modification in B films produced by high-vacuum deposition were studied. Boron films 1 to 30μ thick were deposited on W substrates then separated from the substrate for study. It was concluded that the amorphous, tetragonal, and β-rhombohedral modifications observed are polymorphic forms of pure B. (JRD)

1135 METALLOGRAPHIC INVESTIGATION OF THE TANTALUM–HYDROGEN SYSTEM. Westlake, D. G.; Ockers, S. T. (Argonne National Lab., IL). J. Less-Common Met.; 42: No. 2, 255–260(Sep 1975).

Optical metallography was used to examine phase equilibria in the Ta—H system. It was found that the lattice of metal atoms in the α phase and the low-temperature forms of Ta_2H and TaH are very similar. (JRD)

1136 REACTIONS OF LIQUID LITHIUM WITH THE DIOXIDES OF TITANIUM, ZIRCONIUM, HAFNIUM, AND THORIUM. Barker, M. G.; Alexander, I. C.; Bentham, J. (Univ., Nottingham, Eng.). J. Less-Common Met.; 42: No. 2, 241-247(Sep 1975).

The reaction of the dioxides TiO_2 and ZrO_2 with pure, liquid lithium results in the formation of lithium oxide and the appropriate metal. The reaction of hafnium dioxide gives hafnium metal, lithium oxide, and a tetragonal phase which may be the ternary oxide, $LiHfO_3$. Thorium dioxide does not react with pure, liquid lithium but appears to undergo a change in crystallinity. On reaction with liquid lithium containing dissolved nitrogen, all the oxides are converted, in differing degrees, to either the mononitride or a ternary nitride. (auth)

1137 STRUCTURAL STUDY OF THE SOLUBILITY IN THE SOLID STATE OF TRANSITION METALS IN β-RHOMBOHEDRIC BORON. Lundstroem, T. (Uppsala Univ.). pp 44-51 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Solid solutions of the transition metals Cr, Mn, and Cu in β-rhombohedric B were prepared by arc fusion. The microhardness of these solid solutions was measured and a correlation was made between these results and the volume of the elementary cell. The results of the study of the Moessbauer effect of Fe in β-rhombohedric B were reported. (tr-auth)

1138 PROPERTIES OF ALLOYED BORON. Gabniya, D. L.; Tsomaya, K. P.; Tavadze, F. N. (Inst. of Metallurgy, Tbilisi, USSR). pp 97-100 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Samples of B alloyed with W, Ni, C, V, Zr, or Hf, prepared by zone fusion with subsequent zone leveling and by fusion of mixtures in crucibles, were studied. The results of local x-ray spectral and radiographic analyses of the samples were reported. Values were given for the thermoelectric properties of some of the samples at room temperature and the temperature dependence of these values was shown. (tr-auth)

1139 PROPERTIES OF BORON ALLOYED WITH NICKEL. Arifov, U. A.; Panteleeva, G. V.; Karimov, R. Kh. (Inst. of Electronics, Tashkent). pp 100-106 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The alloying of B with metallic admixtures is described in comparison with literature data. The results of the study of the zone fusion of B with Ni admixtures were reported. The distribution of Ni in the B samples was examined by x-ray microanalysis using an electron probe. The samples were chemically etched and their structure determined. The electric conductivity of the samples was measured in the interval from room temperature to 700°C. (tr-auth)

1140 SOME ASPECTS OF THE CRYSTAL CHEMISTRY OF THE HIGHER BORIDES. Naslain, R.; Guette, A.; Kasper, J. S. pp 160-171 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

With the exception of the UB_4, CaB_6, and UB_{12} type borides, the structures of the borides with a high boron content are generally characterized by a boron framework in which the ideal coordination polyhedron of boron is a pentagonal pyramid. As long as the boron content is small —as for example in MgB_4— those pentagonal pyramids are linked by common edges and the resulting structure is characterized by the existence of boron chains. Details of the recently solved MgB_4 structure are given. When the boron content becomes higher, as for example in NaB_{15} or even more so in the YB_{66} family, the pentagonal pyramids condense and form generally B_{12} octahedra. In these cases the structures are based on a three dimensional boron network built of B_{12} or $B_{12}(B_{12})_{12}$ units. In all the described compounds the existence of a three dimensional boron framework with the metal atoms isolated in boron cages gives to these materials properties close to that of boron itself. (auth)

1141 HIGHER BORIDES OF TUNGSTEN AND MOLYBDENUM. Koval'chenko, M. S.; Serebyakova, T. I.; Bodrova, L. G. (Inst. of Problems in Materials Science, Kiev). pp 174-177 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

A study was made of the conditions of tungsten and molybdenum borides with the composition MeB_4 and their thermal stability in a broad temperature and concentration range. The methods of x-ray phase, metallographic, and chemical analysis were used to establish the single-phase nature of the borides and confirm the presence in them of a hexagonal lattice of the characteristic structural type, the space group D_{6h}^4-$P6_3/mmc$. Some of the electrophysical and thermophysical properties of the indicated borides were investigated in the powdered and sintered states. The investigated tetraborides demonstrated high hardness and good abrasive properties. (auth)

1142 STUDIES OF THE STRUCTURE OF CERTAIN PROPERTIES OF HIGHLY PURE BORON CARBIDE. Bairamashvili, I. A.; Bakhiya, G. N.; Loladze, Sh. A.; Mikadze, Z. M. (Inst. of Metallurgy, Tbilisi, USSR). pp 177-180 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

A study was made of the properties of a fine B_4C powder obtained by magnesiothermic reduction. Special attention was given to the quantity and form of the free carbon. Data are presented from an x-ray analysis in the region of homogeneity of the boron carbide with the composition B_4C to $B_{6.5}C$. The microhardness was measured in the temperature range from 20 to 900°C. Studies were also made of the physical properties such as thermal conductivity, heat capacity, and coefficient of linear expansion. (auth)

1143 FINE CRYSTAL STRUCTURE AND PHASE CONVERSIONS IN BORON NITRIDE. Kurdyumov, A. V.; Pilyankevich, A. N. (Inst. of Problems in Materials Science, Kiev). pp 181-182 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russiar)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The fine crystalline structure and phase conversions in BN were studied. In graphite-like samples, subjected to pulsed compression at high pressure, a new form of BN intermediate in density between the graphite-like and diamond-like formations was observed. The new phase has a cubic elementary cell with 24 atoms. The mechanism for the direct conversion of the graphite-like structure at high pressure was discussed. (tr-auth)

1144 PLACEMENT OF CARBON ATOMS IN STRUCTURES OF THE BORON CARBIDE TYPE. Matkovich, V. I.; Economy, J.; Smith, V. D. (Carborundum Co., Niagara Falls, NY). pp 183-195 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

A more precise interpretation was given of the structure of boron carbide in agreement with which the three-atom interstitial chain consists of two C atoms and one B atom between them. The third C atom probably replaces a B atom bound in the B_{12} icosahedron. The structure of B_2Si was studied. The charts of the electron densities of B_4C and B_2Si were compared. Conclusions were made on the accomodation of C atoms in the boron carbide lattice. (tr-auth)

1145 PACKING OF HEXAGONAL BN LAYERS. Economy, J.; Matkovich, V. I. (Carborundum Co., Niagara Falls, NY). pp 195-202 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Boron nitride in the form of filaments of powdered or monocrystalline samples was studied. Monocrystals of two-layer boron nitride were first prepared and studied. Delocalized electrons were not observed between the layers. The existence of boron nitride crystals in the rhombohedric modification with two types of layer packing was established. (tr-auth)

1146 NETWORK OF TETRAGONAL BORON IN THE LATTICES OF $AlBeB_{24}$ AND ORTHORHOMBIC β-AlB_{12}. Mattes, R. (Inst. of Inorganic Chemistry, Munich); Becher, H. J.; Rethfeld, H.; Krogmann, K. pp 202-205 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

In accordance with earlier investigations β-AlB_{12} was synthesized (which is called $Al_3C_2B_{48}$, too, because it ocasionally contains carbon) by melting boron in the presence of carbon, silicon, or transition elements at 1400 to 1500°C in an excess of aluminum. The resulting crystals are twins of two different orthorhombic lattices. By the addition of beryllium metal to the melt, crystals were obtained with the lattice dimensions of tetragonal boron and an approximate composition $AlBeB_{24}$. A single crystal x-ray structure analysis of this phase was conducted. By heating crystals of —AlB_{12} in the presence of very small amounts of beryllium, a continous transition from the twinned —AlB_{12} phases to $AlBeB_{24}$ was observed. During this process the component with the lower space group symmetry disappeared first. It was possible, therefore, to obtain the other component in a rather pure form. But all crystals were twinned along (110). X-ray structure determination was also complicated by disorder. But it was possible to ascertain to the intimate relation of the lattice of this phase to the network of tetragonal boron. The borides CaB_6, BeB_2, and others could be obtained in well formed single crystals by adding the appropriate metals and crystals of β-AlB_{12} to molten aluminum. (auth)

1147 EFFECT OF CRYSTALLIZATION RATE ON THE BORIDE FORMATION IN IRON—BORIDE MELTS. Tavadze, F. N.; Zoidze, N. A.; Khantadze, D. V.; Garibashvili, V. I.; Tavadze, G. F.; Nakaidze, Sh. G.; Aviokhashvili, D. A. (Inst. of Metallurgy, Tbilisi, USSR). pp 205-207 of Bor: poluchenie

struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

A study was made of the effect of the crystallization rate on the morphology and phase composition of the iron-boron system eutectic. It is demonstrated that as the cooling rate increases there is a transition from cooperative dendritic growth to homogenous nucleation and separate growth of the phases forming the eutectic. The eutectic formed as a result of cooling with a rate of more than 10^{6}°/s comprises crystals of α-iron and the monoboride FeB which replaces the equilibrium phase of the hemiboride Fe_2B in the structure. The observed variation in the structure of the eutectic is connected with the characteristic features of the short-range order in the liquid state. (auth)

1148 PHASE EQUILIBRIA AND RELATED PROPERTIES OF THE Dy–B SYSTEM. Spear, K. E. (Pennsylvania State Univ., University Park). pp 207-215 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The phase behavior in the dysprosium–boron system has been investigated by x-ray and metallographic techniques. Samples were prepared by arc-melting mixtures of the elements on a water-cooled copper hearth in an argon atmosphere. These samples were examined in their quenched state after arc-melting, and again after subsequent annealing experiments. Five intermediate phases of DyB_2, DyB_4, DyB_6, DyB_{12}, and DyB_{66} were identified. Precise lattice parameters were measured for all five phases, as were melting temperatures or limits on these temperatures, and Vickers microhardness values. Melting behavior was deduced from examinations of microstructures of samples quenched from the melt. Indications of solid solution ranges were obtained from comparisons of lattice constant values for Dy-rich and B-rich phase boundaries. Data from the present and previously reported studies were used to construct the first temperature-composition phase diagram for the dysprosium–boron system. The phase equilibria and related properties exhibited by this system are compared with those of other rare earth–boron systems. (auth)

1149 PREPARATION OF NICKEL BORIDE FROM SOLUTION. Peshev, P.; Bliznakov, G.; Gyurov, G. (Inst. of General and Inorganic Chemistry, Sofia). pp 221-224 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The process of preparing nickel boride by the interaction of a solution of nickel acetate with a solution of sodium borohydride was studied. During this interaction a precipitate of a roentgenologically amorphous product with a composition close to Ni_2B was obtained. The most probable sum equation of the reaction producing Ni_2B was determined. (tr-auth)

1150 THERMAL STABILITY OF TETRABORIDES AND HEXABORIDES OF THE RARE EARTH METALS. Etourneau, J.; Merkurio, J. P.; Naslain, R.; Hagenmuller, P. (Univ., Bordeaux). pp 229-232 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The tetraborides and hexaborides were classified according to their capacity to sublimate without decomposition. Interpretations were given in the light of two factors: volatility of the metals capable of dissociating and the factor of shortening the B–B bond inhibiting dissociation. (tr-auth)

1151 PREPARATION OF CALCIUM BORIDE. Knyshev, E. A.; Sachko, A. P.; Khalikov, R. S.; Plyshevskii, Yu. S.; Yumanova, L. V.; Tkachev, K. V. (Ural Scientific Research Chemical Inst., Sverdlovsk, USSR). pp 232-235 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The conditions for the preparation of calcium hexaboride from pure boron-containing products were investigated. An analysis of the physical-chemical characteristics of the material obtained and the data of the technical-economic calculation showed the high efficiency of the technological process developed for the preparation of calcium boride. (tr-auth)

1152 PROPERTIES AND SOME PROSPECTS FOR THE USE OF THE HIGHER BORIDES OF THE ZINC SUBGROUP. Korsukova, M. M.; Gurin, V. N.; Sorokin, V. N.; Yusov, Yu. P.; Terent'eva, Z. P. (Ioffe Physical-Chemical Inst., Leningrad). pp 235-239 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Data were presented on the products of the interaction of B with the elements of the Zn subgroup and particularly with melts of Cd and with the formation of phases containing ~5 wt.% Cd. Data were given on the specific electric resistance of the powders and crystals of $B_{\sim 22}Zn$. Possible use of these borides as a material with volume conductivity was discussed. (tr-auth)

1153 ELECTRON AND MAGNETIC PROPERTIES OF HEXABORIDES OF THE RARE EARTH METALS OXIDIZED TO THE TWO-VALENT STATE. Merkurio, J. P.; Etorneau, J.; Naslain, R.; Hagenmuller, P. (Univ., Bordeaux). pp 240-244 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The electrical and magnetic properties of EuB_6 and YbB_6 were studied. These compounds are semiconductors. The activation energies are 0.3 for EuB_6 and 0.14 eV for YbB_6. The character of the change of the electron constituents of the heat capacity at low temperatures also confirms the semiconducting nature of YbB_6. The temperature dependence of the thermo emf was studied. (tr-auth)

1154 THERMOEMISSION OF THE DODECABORIDES OF TRANSITION METALS. Samsonov, G. V.; Okhremchuk, L. N.; Podchernyaeva, I. A.; Fomenko, V. S.; Odintsov, V. V. (Inst. of Problems in Materials Science, Kiev). pp 245-247 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The thermal emission properties of cubic dodecaborides of the metals of the Y subgroup Y, Tb, Dy, Ho, Er, Tm, Yb, and Lu and also U and Zr with structure of the UB_{12} type were studied. On samples prepared by powder metallurgy methods the temperature dependence of the electron emission was measured in the temperature range from 1600 to 2000°K. (tr-auth)

1155 ELECTRICAL PROPERTIES OF ALUMINUM DODECABORIDE (α-AlB_{12}). Berezin, A. A.; Golikova, O. A.; Zaitsev, V. K.; Kazanin, M. M.; Orlov, V. M.; Stil'bans, L. S.; Tkalenko, E. N. (Ioffe Physical-Technical Inst., Leningrad). pp 248-251 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The temperature dependence of the electric conductivity, thermo emf, and Hall coefficient were measured for the α modification of AlB_{12} in a wide temperature interval from 300 to 1700°K. The spectral dependence of the reflection coefficient was also measured. (tr-auth)

1156 INVESTIGATION OF BORON NITRIDE FILMS ON DIFFERENT SUBSTRATES. Karpinos, D. M.; Listovnichaya, S. P.; Aivazov, V. Ya.; Bogomaz, N. A. (Inst. of Problems in Materials Science, Kiev). pp 251-256 of Bor: poluchenie struktura i svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Films of hexagonal boron nitride with stoichiometric composition were formed by high-frequency sputtering of target of boron nitride in a pure N_2 medium. An evaluation was made of the adhesive force between the coating and the metallic substrate of nitrides, stainless steel, Mo, Co, or W. (JSR)

1157 THERMAL CONDUCTIVITY OF BORON AND ITS COMPOUNDS. Golikova, O. A.; Zaitsev, V. K.; Orlov, V. M.; Petrov, A. V.; Tkalenko, E. N. (Ioffe Physico-Technical Inst., Leningrad). pp 25-32 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian)

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132–P2.

A study was made of the temperature functions of the thermal conductivity of amorphous boron and single crystals of β-rhombohedral boron and the α and β modification of aluminum dodecaboride. The results obtained are related to the characteristic features of the crystal lattice of these substances. (auth)

1158 OPTICAL PROPERTIES OF BORON AND ALUMINUM DODECABORIDE IN THE IR REGION. Golikova, O. A.; Drabkin, I. A.; Zaitsev, V. K.; Kazanin, M. M.; Mirlin, D. N.; Nel'son, I. V.; Tkalenko, E. N.; Khomidov, T. (Ioffe Inst. of Physics and

Tech., Leningrad). pp 44-58 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

The optical properties of zone-melted β-B was measured at high temperature in the region of impurity conductivity caused by the growth of the concentration of holes with increased temperature. A comparison was made of the optical and electrical properties and on the basis of this comparison conclusions were drawn on the temperature dependence of the mobility. The lattice absorption of α- and β-B was studied. α- and β-aluminum dodecaboride with the frame structure of B and the ir absorption of amorphous B were also studied. The results were compared with the structural singularities of these materials. (tr-auth)

1159 PRESENT STATUS AND PROSPECTIVE DEVELOPMENT OF STUDIES ON HIGH-BORON BORIDES. Paderno, Yu. B. (Inst. of Problems in Materials, Kiev). pp 97-105 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

A review is given on the present status of the study of the structure of the higher borides. It is shown that borides with a framework structure are formed basically with atoms of metals which are characterized in the ground state either by energy stability or electron structure close to it. This is illustrated by a discussion of CrB_4, ThB_4, CaB_6, UB_{12}, CrB_{41}, and YB_{66}. The discussion leads to the conclusion that electron factors no less than structural ones are responsible for the formation of given borides. (JSR)

1160 BORIDES OF THE RARE EARTH METALS WITH A FRAMEWORK STRUCTURE OF THE BORON ATOMS. Samsonov, G. V.; Paderno, Yu. B.; Levandovskii, V. D.; Konovalova, E. S. (Inst. of Problems in Materials, Kiev). pp 106-113 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

Literature data and original experimental data are presented on the physical characteristics of SmB_6 in the temperature range from that of liquid He to room temperature. This examination of the physical characteristics at low temperature made it possible to determine the symmetry form of the crystalline field in structures of this type. A quantitative evaluation was made of the size of the crystalline field constant. The change of the valence state of the Sm atoms at low temperatures was confirmed. (JSR)

1161 NATURE OF THE PHASE DIAGRAM OF SOME TRANSITION METALS WITH BORON. Upadkhaiya, G. Sh. (Univ. of Rurk, India). pp 115-123 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

The structure of the phase diagrams of the borides of the transition metals Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, and W are discussed theoretically on the basis of examples of the systems Ti–Zr–B, Ti–Hf–B, and Zr–Hf–B. The carbon borides of the transition elements are also discussed and illustrated with examples of the pseudobinary systems $TiB_2-TiC_{0.92}$, ZrB_2-ZrC, $HfB_2-HfC_{0.9}$, W_2B-W_2C, and $WB-W_2C$. Examples are also given of the pseudobinary system M_xB_y-C. (JSR)

1162 ELECTRON MICROSCOPIC STUDY OF THE FRACTURE STRUCTURE OF THE HEXABORIDES OF SOME METALS. Paderno, Yu. B.; Pilyankevich, A. N.; Paderno, V. N. (Inst. of Problems in Materials, Kiev). pp 124-132 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

Electron microscopic studies were made of the fracture surface of the hexaborides of Ba, Sr, Eu, Ca, Yb, La, Sm, Pr, Nd, and Gd. The microfractographs obtained are given and show that BaB_6 has the most extended surface and therefore the greatest resistance to fracture. This result and those obtained with the other borides confirm that an increase of the role of the Me–Me bond leads to an increase of the plasticity of the material. (JSR)

1163 NEW TERNARY BORIDES CONTAINING RARE EARTH METALS AND THEIR CRYSTALLINE STRUCTURE. Kuz'ma, Yu. B.; Svarichevskaya, S. I. (Lvov State Univ.). pp 133-137 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

By study of monocrystals the structure of the three borides $CeCr_2B_6$, $YCrB_4$, and Y_2ReB_6 was completely determined. The crystalline structure of $CeCr_2B_6$ belongs to a new type and can be considered as a stack of triagonal prisms, tetrahedron pyramid, and vacant tetrahedron. The structure of $YCrB_4$ can be considered as a derivative of the AlB_2 type. The structure of Y_2ReB_6 is close to the same type of structure, but the B atoms form lattices of five, six, and seven membered chains. (JSR)

1164 PREPARATION OF MONOCRYSTALS AND FILMS OF LANTHANUM HEXABORIDE. Niemyski, T.; Pracka, I.; Jun, J. (Inst. of Electronic Tech., Warsaw). pp 146-154 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

The procedure used for the preparation of LaB_6 from powdered B and La_2O_3, mixed in stoichiometric ratio and heated in an induction furnace at 1800°C for 4 h, is described. The monocrystals obtained were used in the preparation of LaB_6 films by the method of cathode sputtering. The structure and the optical and electrical properties of the films were determined. The specific electrical resistivity, Hall constant, and carrier concentrations were measured and compared with literature values. The specific resistivity of the films at room temperature is significantly different from that of the cast material. The films had a metallic character for the electric conductivity. (JSR)

1165 STUDY OF LANTHANUM HEXABORIDE PREPARED UNDER DIFFERENT CONDITIONS. Zhuravlev, N. N.; Manelis, R. M.; Nikanorova, I. A. (Moscow State Univ.). pp 162-171 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

Powders of LaB_6 of stoichiometric composition were prepared by borothermal reduction of the oxide in a vacuum and compressed at pressures of 75, 80, and 85 kbar at corresponding temperatures of 1650, 2000, and 2300°C. During compression of the powders during the sintering process a decomposition of the hexaboride into the boride, enriched in B, and free B was observed. The hexaboride can exist in a wide interval of compositions because of the formation of defect structures with deficits in La atoms in lattices of the CaB_6 type. The formation of the defect structure is connected with the preparation conditions of the borides. (JSR)

1166 DAMAGE IN GALLIUM ARSENIDE CRYSTALS PRODUCED BY ION IMPLANTATION, ABRASION, AND BALL-MILLING. Tunkasiri, T.; Lewis, D. (Surrey Univ., Guildford, Eng.). J. Mater. Sci.; 10: No. 8, 1367-1374(Aug 1975).

Gallium arsenide single crystals implanted with tellurium and cadmium ions at 50 and 150 keV at room temperature were examined using RHEED. Damage depth profiles were measured. Annealing was carried out to investigate the effect of temperature on the implantation damage. These effects which proved be very complicated, included decomposition of the gallium arsenide, formation of beta gallium oxide and gallium telluride, and preferred orientation of the gallium arsenide. Comparisons were made with the annealing behavior of ball-milled gallium arsenide using x-ray diffraction line broadening. The effects of various types of mechanical damage associated with specimen polishing of the gallium arsenide single crystals were also investigated. (auth)

1167 SOLUBILITY OF HYDROGEN IN THE SYSTEMS TITANIUM–ALUMINUM–HYDROGEN, TITANIUM–VANADIUM–HYDROGEN, AND TITANIUM–ALUMINIUM–VANADIUM–HYDROGEN IN THE TEMPERATURE REGION OF 800 TO 1,000°C AT HYDROGEN PRESSURES OF 0.1 TO 400 mm. Hg. Kauder, G. W. Clausthal-Zellerfeld, Ger.; Technische Univ. Clausthal (1973). 38p. (In German). INIS.

Thesis.

The hydrogen concentrations in Ti–Al, Ti–V and Ti–Al–V alloys were determined in the temperature region from 800 to 1,000°C and at hydrogen pressures of 0.1 to 400 mm Hg using a gravimetric measuring process. The results allowed drawing of hydrogen activity slopes in the titanium rich corner of the systems titanium–hydrogen, titanium–aluminium–hydrogen, titanium–vanadium–hydrogen and such for the technical titanium alloys Ti–6Al–4V and Ti–6Al–6V. In spite of the antagonistic effects of the elements aluminium and vanadium on the stabilization of the α and β phase regions of titanium, a hydrogen-activity-increasing effect was always found in which the aluminium influence was greater than that of vanadium. Breaks occurred in the hydrogen activity curves and phase boundaries, and phase regions were determined over their positions. Isothermal phase diagrams for the titanium-rich corner of the system titanium–aluminium–hydrogen at 800, 850, and 900°C and for the titanium-

rich corner of the titanium–vanadium–hydrogen system at 900, 950 and 1,000°C were drawn up from the hydrogen activity curves. (GE)

1168 STUDIES IN THE SYSTEM Nb–H. Ableiter, M. Saarbruecken, Ger.; Universitaet des Saarlandes (1973). 58p. (In German). INIS.

Thesis.

The Nb–H system was investigated in the concentration limits of the known state diagram between 4.2 and 465°K by means of electrical resistance and Hall effect measurements as well as nuclear resonance spectroscopy. In the temperature and concentration range investigated, hydrogen exhibited no uniform scattering behaviour compared with the charge carriers. Hall effect measurements showed that the hydrogen acts as electron donator in the two-phase region α/β. A defect electron concentration of approximately 0.5 hols/Nb atom was estimated for the β-phase from the Hall effect increase. The Moessbauer spectra in Nb (^{57}Fe)–H system exhibited several isomeric, pushed together resonance lines, which were clearly assigned to the various Nb hydride phases. The magnetic field spectra indicated a magnetic moment of the ^{57}Fe impurity in the β-hydride phase. By applying the law of levers to the electric resistance and Moessbauer measurements (intensity), it was possible to extend the Nb-H state diagram to low temperatures. (GE)

1169 MID-1970'S IMBALANCE IN ZIRCON SUPPLY AND DEMAND. Van Gordon, D. V., Collins, R. E. (M and T Chemicals, Inc., Rahway, NJ). Am. Ceram. Soc. Bull.; 54: No. 9, 801-802(Sep 1975).

From 27th Pacific Coast Regional Meeting of the American Ceramic Society; North Hollywood, CA (24 Oct 1974).

Mining and the historical development of the zircon market are briefly reviewed. Causes of the fluctuations in the zircon demand and supply and in the price are discussed. Possible adjustments (such as substitution of other materials in the steel foundry) are listed. Future uses of zircon will probably be limited to those which can justify high prices and those for which there are no substitutes. (DLC)

1170 PREPARATION OF CERAMIC FORMS USING A REMOVABLE MANDREL. Morgan, C. S.; Federer, J. I.; Tennery, V. J. (Oak Ridge National Lab., TN). Am. Ceram. Soc. Bull.; 54: No. 9, 797-798(Sep 1975).

A method for producing tubes and more complex shapes consists of packing a powder or slurry around a mold of a low melting metal alloy encased in a plastic container. The packed form is isostatically pressed, the cover removed, and the mold separated by melting the metal. The formed ceramic part can then be sintered. UO_2 tubes and Al_2O_3 spirals were made by this method. (DLC)

1171 EFFECT OF YTTRIA ADDITIONS ON HOT-PRESSED Si_3N_4. Gazza, G. E. (Army Materials and Mechanics Research Center, Watertown, MA). Am. Ceram. Soc. Bull.; 54: No. 9, 778-781(Sep 1975).

From 76th annual meeting of the American Ceramic Society; Chicago, IL (30 Apr 1974).

Various grades of Si_3N_4 powder were hot pressed with Y_2O_3 additions of up to 20 wt percent. Effects of powder purity, percent addition, and testing temperature on resultant properties are discussed with supplemental evidence from crystallographic and Auger analyses. The highest elevated temperature strengths yet reported for Si_3N_4 were obtained with such additions, and significant potential is indicated for use in high temperature gas turbines. (auth)

1172 THERMODYNAMIC STUDY OF CALCIA, LANTHANIA, AND YTTRIA DOPED NONSTOICHIOMETRIC CERIUM DIOXIDE. Garnier, J. E. Milwaukee; Marquette Univ. (1974). 355p. University Microfilms Order No. 75-14,986.

Thesis (Ph. D.).

Thermogravimetric measurements were performed on CaO-, La_2O_3-, and Y_2O_3-doped nonstoichiometric cerium dioxide (i.e., Ce/sub 1-y/Ca/sub y/O/sub 2-y-x/, Ce/sub 1-z/La/sub z/O/sub 2-1/2z-x/, and Ce/sub 1-z/Y/sub z/O/sub 2-1/2z-x/) in the temperature range 800 to 1500°C and from oxygen pressures of 10^{-1} to 10^{-21} atm. From these data the deviation from stoichiometry x equals x(T,P/sub O_2/)/sub y or z/ was determined for values of y equals 0.01, 0.07, 0.10 and 0.14 for Ce/sub 1-y/Ca/sub y/O/sub 2-y-x/ and a value of z equals 0.246 for Ce/sub 1-z/La/sub z-/O/sub 2-1/2z-x/ and Ce/sub 1-z/Y/sub z/O/sub 2-1/2z-x/. The experimental observation that x alpha P/sub O_2//sup -1/4/ is rationalized on the basis of the above model for the cases where y and 1/2z greater than x. At large deviations from stoichiometry the dependence of x equals x(T,P/sub O_2/)/sub y or z/ is similar to the nonstoichiometric behavior of "pure" CeO/sub 2-x/ when y equals 0.01 or 0.07. The dependence of DELTA anti H/sub O_2/ and DELTA anti S/sub O_2/ on log x is also similar. However, for y equals 0.10 and 0.14 and z equals 0.246 the nonstoichiometric behavior and the dependence of DELTA anti H/sub O_2/ on log x differs significantly from the behavior of "pure" CeO/sub 2-x/. If the defects remain noninteracting and randomly distributed in the region where x greater than y or 1/2z then the comparison of both DELTA anti H/sub O_2/ and DELTA S/sub T//sup v/ (calculated) with the total site fraction of oxygen vacancies and altervalent cations reveals that the values of DELTA anti H/sub O_2/ and DELTA S/sub T//sup v/ (calculated) for doped-CeO/sub 2-x/ lie within a band about the corresponding DELTA anti H/sub O_2/ and DELTA S/sub T//sup v/ (calculated) values for "pure" CeO/sub 2-x/. (Diss. Abstr. Int., B)

1173 PREPARING MICROSPHERES OF ACTINIDE NITRIDES FROM CARBON CONTAINING OXIDE SOLS. Triggiani, L. V. (to W. R. Grace and Co.). US Patent 3,904,736. 9 Sep 1975. Filed date 1 Jun 1966. 14p.

A process is given for preparing uranium nitride, uranium oxynitride, and uranium carboxynitride microspheres and the microspheres as compositions of matter. The microspheres are prepared from carbide sols by reduction and nitriding steps. (Official Gazette)

Metals and Alloys

Refer also to abstracts 2395, 2491, and 2494.

1174 (ORNL-5089) METALS AND CERAMICS DIVISION MATERIALS SCIENCE ANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1975. McHargue, C. J. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 68p. Dep. NTIS $5.45.

An overview of research programs on metals and ceramics is presented as a summary of quarterly and semiannual reports. Summaries of research on structure of materials, deformation and mechanical properties, transport phenomena, and radiation effects are given. (JRD)

Corrosion and Erosion

Refer also to abstracts 1092, 1167, 1371, 1407, 2269, 2333, 2352, and 2433.

1175 (AD/A-003900) ROLE OF PASSIVE FILM GROWTH KINETICS AND PROPERTIES IN STRESS CORROSION AND CREVICE CORROSION SUSCEPTIBILITY. Technical Summary Report No. 5, 1 March–31 December 1973. Kruger, J.; Ambrose, J. R. (National Bureau of Standards, Washington, D. C. (USA)). Sep 1974. 89p. (NBSIR-74-583). NTIS $4.75.

A study of the effect of alloying chromium and molybdenum in ferritic stainless steels has been made using techniques to study repassivation kinetics (tribo-ellipsometry) and depassivation kinetics (a recently developed ellipsometry technique for studying optical changes occurring within a crevice). Constant strain rate studies were performed using AISI 304 stainless steel exposed to acidified 1.0N NaCl solution (pH = 3.0). In this particular environment, repassivation kinetics measurements using the tribo-ellipsometric technique had shown that the metal dissolution rates were rather large due to reduced film repair kinetics, indicating the possibility of susceptibility to stress corrosion cracking (SCC). Reduced time to failure and maximum sustained load at a one strain rate suggest a relationship between SCC, repassivation kinetics, and rate of pure metal production. A review of current approaches to the study of stress corrosion and a discussion of how these approaches can lead to new failure prediction tools is given. (GRA)

1176 (AD/A-004169) INVESTIGATION OF HIGH-TEMPERATURE OXIDATION REACTIONS. Final Report, 1 Apr 1971–31 October 1973. Rapp, R. A.; Hirth, J. P. (Ohio State Univ. Research Foundation, Columbus (USA)). Oct 1974. Contract F33615-71-C-1492. 22p. (OSURF-3194-F). NTIS $3.25.

High temperature oxidation reactions were studied, with detailed experimental investigation of two problems: (1) the compatibility of components in multi-phase, high temperature systems as exemplified by displacement reactions in the solid state, and (2) the high temperature oxidation of Ni-Cr-W and Co-Cr-W alloys. From a knowledge of the pertinent thermodynamic and transport parameters of the reaction couples (nickel/cuprous oxide, cobalt/cuprous oxide, iron/cuprous oxide, and iron/nickel oxide), the selection of the product morphologies and the resulting kinetics of reaction were predicted and compared with experiment. A detailed theory was presented and tested to interpret the aggregate-lamellar product microstructure of the iron/cuprous oxide couple. The effect of tungsten additions on the oxidation behavior of 20% Ni–Cr alloys and of 30% Co–Cr alloys was studied by thermogravimetric, electron microprobe, and metallographic methods. For

each set of alloys a partitioning of W to the metallic phase was found, and the resulting phase changes were interpreted in terms of the ternary phase diagrams for the alloys. (GRA)

1177 (AD/A-004445) OXIDATION RESISTANCE OF ALLOYS OF COMPOUND TiAl WITH NIOBIUM AT 800 AND 1000°C. Zelenkov, I. A.; Martynchik, E. N. Translated by M. Olaechea from Metallofizika; No. 42, 63-66(1972). 12p. (FTD-MT-24-2689-74). NTIS $3.25.

1178 (CONF-750401--3) CORROSION OF NICKEL ALLOYS IN NUCLEAR FUEL REPROCESSING. Paige, B. E. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). 1975. 17p. Dep. NTIS $4.00.

From NACE International Corrosion/75 conference; Toronto, Canada (14 Apr 1975).

Corrosion studies were made of high Ni alloys in process solutions which will be encountered during reprocessing of fuel from Shippingport PWR Core 2, seeds 1 and 2. The alloys were Hastelloy C-276 and C-4, Inconel 625, Incoloy 825, Hastelloy S, Hastelloy G, and Inconel 671. Effects of process variables were studied. Welded Hastelloy C-276 vessels were constructed and tested. (DLC)

1179 (GEAP-14029-3) STEAM GENERATOR MATERIALS ENGINEERING. Third Quarterly Report, January–March 1975. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Apr 1975. Contract AT(04-3)-893. 22p. AT.

The primary objective of the work reported is to characterize materials, mainly $2\frac{1}{4}$Cr-1Mo and stainless steels, to assure that satisfactory materials compatibility is achieved with expected LMFBR steam generator environments. 34 references. (auth)

1180 (HAN--64841) AEC URANIUM FIRE EXPERIENCE. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 17 Sep 1954. 27p. Dep. NTIS $4.50.

An inquiry was made to all Operations Offices soliciting literature references on any research on U fires, case histories of any fires involving massive U, and suggestions for research on U fire properties. Replies, a field trip to AEC contractor sites, and a review of individual fire reports form the basis of this report. Five basic types of U fires are distinguished. Water and H_2 were found to increase the pyrophoricity of U. Recommendations are given for a research program. (DLC)

1181 (LA-UR-75-1628) SYSTEM FOR STUDYING THE INITIAL STATES OF GAS-METAL REACTIONS. Andrews, G. H. Jr.; Alire, R. M.; Czanderna, A. W. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 11p. (CONF-751023-1). Dep. NTIS $4.00.

From 22nd national vacuum symposium; Philadelphia, Pennsylvania, USA (28 Oct 1975).

An ultrahigh vacuum system was constructed for use in conjunction with a Rodder ultramicrobalance for gravimetric studies of metal-gas reactions. Though intended specifically for the study of the early stages of uranium oxidation, the apparatus and techniques are readily adaptable to other metal-gas systems. The system is pumped by sorption, titanium sublimation, and noble ion pumps, which avoid the need for oil diffusion pumping thus eliminating the possibility of sample contamination by oil vapor. Provisions for in situ sputter cleaning of samples as well as electron beam heating and infrared thermometry were built into the system. Gas compositions are monitored with a residual gas analyzer. (auth)

1182 (MLM-2209) PLUTONIUM-238 DIOXIDE/T-111 COMPATIBILITY STUDIES. Jones, G. J.; Selle, J. E.; Teaney, P. E. (Mound Lab., Miamisburg, Ohio (USA)). 19 Sep 1975. Contract E-33-1-Gen-53. 58p. Dep. NTIS $5.45.

The tantalum-base alloy, T-111, is an ideal radioisotope encapsulant from the aspect of mechanical properties, but unfortunately undergoes severe oxygen embrittlement during long-term, high-temperature exposure to PuO_2. A study was undertaken in an effort to improve T-111/PuO_2 compatibility by testing the hypothesis that reduction of fuel stoichiometry to the range $PuO_{1.75}$ to $PuO_{1.5}$ would suspend the embrittlement process by producing a state of thermodynamic equilibrium within the capsule. Test temperatures ranged from 773 to 1373°K, with aging times of 60 days, 240 days, and 2 y. The desired reaction did not proceed rapidly enough at the aging temperatures to stop T-111 embrittlement. Capsules heated above 1573°K for 1 hr showed no signs of embrittlement during aging, even after 2 y at temperatures as high as 1173°K. Results with test specimens employing pelletized fuel indicated the solid-state diffusion of oxygen from the fuel to the T-111 was the dominating transport process. In nonpretreated capsules oxygen diffusion in T-111 was the rate-controlling process. Pretreatment does result in the desired thermodynamic equilibrium at temperatures up to at least 1173°K. (auth)

1183 (N-75-21563) EVALUATION OF T-111 FORCED-CONVECTION LOOP TESTED WITH LITHIUM AT 1370°C. DeVan, J. H.; Long, E. L. Jr. (Oak Ridge National Lab., Tenn. (USA)). Apr 1975. Contract W-7405-eng-26. 133p. (NASA-CR-134745; ORNL-TM-4775). NTIS $5.75.

A T-111 alloy (Ta–8 percent W–2 percent Hf) forced-convection loop containing molten lithium was operated 3000 h at a maximum temperature of 1370°C. Flow velocities up to 6.3 m/s were used, and the results of this forced-convection loop are very similar to those observed in lower velocity thermal-convection loops of T-111 containing lithium. Weight changes were determined at 93 positions around the loop. The maximum dissolution rate occurred at the maximum wall temperature of the loop and was less than 1.3 microns/year. Mass transfer of hafnium, nitrogen, and, to a lesser extent, carbon occurred from the hotter to cooler regions. Exposed surfaces in the highest temperature region were found to be depleted in hafnium to a depth of 60 microns with no detectable change in tungsten content. There was some loss in room-temperature tensile strength for specimens exposed to lithium at 1370°C, attributable to depletion of hafnium and nitrogen and to attendant grain growth. (STAR)

1184 CORROSION-ELECTROCHEMICAL BEHAVIOR OF METALS IN ORGANIC MEDIA. 1. Passivation and Anodic Dissolution of Molybdenum in Nonaqueous Acetate Solutions. Tsinman, A. I.; Pischik, L. M.; Makovel, G. L. (Severodonetskij Filial Gosudarstvennogo Inst. Azotnoj Promyshlennosti UZ). Elektrokhimiya; 10: No. 9, 1321-1327(Sep 1974). (In Russian).

For English translation see the journal Sov. Electrochem.

In anhydrous acetate solutions molybdenum was passivated and dissolved only after reaching a treatment potential of formation of MoO_3. The presence of molybdic acid ions was determined polarographically. There is no specific effect of anions (including those containing oxygen) on passivation and the kinetics of anode dissolution. The addition of water facilitates dissolution, decreasing the repassivation potential and the slope of the anode polarization curve. The kinetics of hydrogen release in acetate solutions is given by Tafel's equations, $\alpha \approx 0.5$, $i_0 \approx 1 \times 10^{-5}$ A/cm^2 in aqueous acetate and chloride solutions at 90°C. (tr-auth)

1185 INVESTIGATION INTO CARBURIZATION OF NIOBIUM- AND NIOBIUM ALLOY SURFACE IN HYDROCARBON MEDIUM. Bondarenko, E. A.; Kutsev, V. S. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 25-32 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

In the interaction of Nb and its alloys with a hydrocarbon medium at 1000 or 1200°C, in the surface layers are formed fine, dispersed precipitates of the carbide phase which strengthen the surface layer of the material. The addition of 5 wt % W to the Nb decreases the degree of carbonization and the addition of 5 to 7% rhenium increases it. (tr-auth)

1186 CORROSION RESISTANCE OF VANADIUM ALLOYS IN 3% NaCl SOLUTION. Migaj, L. L.; Arons, V. I.; Mal'chevskii, E. G.; Druzhinina, I. P.; Vorob'eva, L. P. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 73-81 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

The corrosion resistance of binary and ternary V alloys in simulated sea water (3% NaCl) was studied. V + 10% Ti and V + 20% Nb showed high corrosion resistance. The effect of deformation and recrystallization and of change in pH of the solution on corrosion resistance of alloys were studied. Tests were made to determine the tendency of these alloys to corrosion disintegration. (tr-auth)

1187 NIOBIUM HYDROGEN EMBRITTLEMENT IN HYDROCHLORIC ACID. Arons, V. I.; Migai, L. L. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 69-73 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

A method was developed for cathode hydrogenation of Nb in HCl. The effect of polarization time, cathode current density, solution concentration and temperature, and stimulator concentration on the process was determined. Using the method, the effect of the degree of deformation on the tendency to hydrogen embrittlement was studied. Hydrogen embrittlement of Nb occurred at hydrogen concentrations below the limit of its solubility in Nb. (tr-auth)

1188 SOLUBILITY OF NITROGEN AND CONDITIONS FOR EXISTENCE OF NITRIDES IN LIQUID NICKEL BASE ALLOYS

OF THE TYPE EI-698. Rakovshchik, G. M.; Linchevskii, B. V. Tekhnol. Legk. Splavov.; No. 9, 60-64(1974). (In Russian).

The thermodynamic characteristics for interaction of nitrogen with liquid, nickel-base alloys (EI-698) were studied. Calculations were made which allowed extrapolation of experimental data over a wide range of temperatures and nitrogen pressures. Conditions for nitride formation in molten EI-698 alloys in industrial furnaces were investigated. (tr-auth)

1189 ON KINETICS OF HYDROGEN EXTRACTION FROM SOLID METALS. Gabidullin, R. M.; Kolachev, B. A.; Ivanishchev, G. V. (Moskovskij Aviatsionnyj Tekhnologicheskij Inst. (USSR)). Fiz. Metal. Metalloved.; 37: No. 6, 1182-1190(Jun 1974). (In Russian).

For English translation see the journal Phys. Met. Metallogr.

Based on a hypothesis of local equilibria in hydrogen distribution between a solid solution and a trapping in pores and hydrides, a mathematical model is proposed for the process of degassing of solid metals. For porous samples the kinetic equation for degassing was solved on a computer for most cases met in practice. Kinetic degassing curves are presented as nomograms. For hydride-forming metals an analytical solution is given for the problem of hydrogen distribution in the metal at different stages of extraction. The thickness of the zone not containing hydrides changed with time according to a parabolic law. The ratio between the actual and apparent diffusion coefficients in metals are discussed. (tr-auth)

1190 DISTRIBUTION OF OXYGEN BETWEEN METAL AND SLAG DURING DEEP OXIDIZING BLASTING OF A COMPOSITE MELT. Filippov, S. I.; Paderin, S. N.; Laktionov, S. V. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 5, 8-12(1974). (In Russian).

For English translation of selected articles see the journal Stal USSR.

It is shown that thermodynamic calculations for the solubility of oxygen in a metal bath in the presence of alloying elements (Ni, Co, Mo) and experimental data on the content of oxygen at the end of prolonged oxidative blowing of an arc-furnace bath give results close to each other. Thermodynamic equations are derived for the solubility of oxygen as a function of the composition and temperature of the metal and of the activity of oxygen in the slag. By mathematical treatment of the experimental data an equation is obtained for the temperature dependence of the oxygen content in the metal. It is possible to estimate the degree of oxidation of the slag from data on the oxygen content in the metal. By thermodynamic calculations it is possible to predict the degree of oxidation of the metallic and slag phases in the final stages of prolonged carbon removal in a metal bath of complex composition. (tr-auth)

1191 INTENSITY OF DECARBONIZATION OF MOLTEN METAL AND ASSOCIATED PROCESSES IN THE PRESENCE OF ALLOYING ELEMENT. Filippov, S. I.; Krasheninnikov, M. G.; Vinichenko, N. I. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 7, 9-14(1974). (In Russian).

For English translation see the journal Stal USSR.

By the use of an experimental technique of differential levitation a study was made of the most important kinetic parameters in the removal of carbon from melts in the presence of alloying elements: the concentration of carbon that corresponds to the initial transfer of gas from the surface to the body of the melt, the amount of oxygen accumulated by the melt, carryover of metal and slag, and the concentration of carbon that protects the alloying elements and iron from oxidation. (tr-auth)

1192 SOLUBILITY OF HYDROGEN IN LIQUID ZIRCONIUM. Lakomskij, V. I.; Grigorenko, G. M.; Korzhov, M. P.; Solomentsev, A. N. Izv. Akad. Nauk SSSR, Metal.; No. 5, 69-72(Sep 1974). (In Russian).

For English translation see the journal Russ. Metall.

An experimental study was made of the solubility of hydrogen in zirconium, which was found to have a square root dependence. An analytical expression was obtained for the dependence of hydrogen solubility in zirconium as a function of temperature, and an expression was obtained for determining the partial molar free energy of displacement. The partial standard entropy of the hydrogen dissolved in zirconium was determined. (tr-auth)

1193 ORDER-DISORDER TRANSITION AND ADATOM-ADATOM INTERACTIONS IN A CHEMISORBED OVERLAYER OXYGEN ON W (110). Buchholz, J.C.; Lagally, M.G. (College of Engineering, University of Wisconsin, Madison, Wisconsin 53706). Phys. Rev. Lett. 35: No. 7, 442-445 (18 Aug 1975).

The intensity and angular width of superlattice reflections in low-energy electron diffraction from W (110) $p(2 \times 1)$-O are measured as the overlayer disorders. The width of the reflections increases with temperature, indicating a shrinking of island size. An adatom-adatom interaction energy is determined for this system by using a short-range-order model and calculating the diffracted intensity from a chain of atoms. (auth)

1194 CORROSION OF GROUP 5A METALS IN FLOWING SODIUM. Barker, M. G.; Morris, C. W. (Univ., Nottingham, Eng.). J. Less-Common Met.; 42: No. 2, 229-239(Sep 1975).

The corrosion of vanadium, niobium, and tantalum in flowing, liquid sodium was examined. The ternary oxides, Na_4VO_4 and $NaVO_3$ were observed on the surface of vanadium, through a matrix of sodium, by x-ray diffraction, together with an oxygen solid solution in the vanadium. For niobium and tantalum, only a single, ternary oxide corrosion product, Na_3MO_4(M = Nb, Ta), was observed, together with an oxygen solid solution. It was concluded that Group 5A metals will form ternary oxide corrosion products when exposed to liquid sodium at 600°C containing more than five parts per million of oxygen. (auth)

1195 HYDROGEN ABSORPTION IN INTERMETALLIC COMPOUNDS OF THORIUM. Buschow, K. H. J.; van Mal, H. H.; Miedema, A. R. (Philips Research Labs., Eindhoven, Netherlands). J. Less-Common Met.; 42: No. 2, 163-178(Sep 1975).

The formation of ternary hydrides was studied for 15 intermetallic compounds of thorium, (five compounds in each of the systems Th–Ni, Th–Co, and Th–Fe). With the exception of the compounds richest in 3d-metal, they all form hydrides by reaction with hydrogen gas at room temperature. The hydrides prepared include the compounds $ThCoH_4$, $ThNi_2H_5$ and $Th_7Ni_3H_{28}$. Some compounds ($Th_2Co_7H_4$, $Th_2Fe_7H_5$) have equilibrium hydrogen pressures near to 1 atmosphere at 300°K. The results are discussed in terms of a model that predicts the enthalpy of formation of a ternary hydride from the knowledge of ΔH for the corresponding binary hydrides and binary intermetallic compounds. In addition experimental results on hydrogen absorption in $LaNi_5$ and related compounds, published earlier are discussed. The agreement between model predictions and experiment is nominal. (auth)

1196 OXIDATION PROPERTIES OF TRANSITION METALS. Smeltzer, W. W.; Young, D. J. (McMaster Univ., Hamilton, Ont.). Prog. Solid State Chem.; 10: 17-54(1975).

The subject is reviewed under the following heads: transition metal oxides (crystal structures, thermodynamic properties, lattice defect structure, diffusion); low-temperature film formation (mechanism of oxidation, ionic and electronic transport equations, integrated transport equations, transport equations and the oxidation rates, application of film formation theory); high-temperature scale formation (parabolic oxidation by ambipolar diffusion, application of parabolic scale formation theory); development of film and scale structure (oxide morphologies and structures, transport equations and oxidation rates, correlations of structures with oxidation rates). (206 references.) (UK)

Preparation and Fabrication

Refer also to abstracts 52 and 2483.

1197 (AD/A-004340) EFFECT OF THERMOPHYSICAL PROPERTIES ON THE NATURE OF THE WELDING OF CERTAIN METALS BY LASER RADIATION. Balatskii, A. A.; Barabov, M. S. Translated from Fiz. Khim. Obrab. Mater.; No. 4, 8-13(1973). 10p. (NISC-TRANS-3608). NTIS $3.25.

The relationship of penetration depth and diameter to radiation parameters and thermophysical properties was determined for a number of metals, e.g., nickel, kovar, constantan, and molybdenum. (GRA)

1198 (BNWL-SA-5325) SPUTTER-DEPOSITION OF METASTABLE Ta–Pu AND Co–Pu ALLOYS. Allen, R. P.; Dahlgren, S. D.; Wang, R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 9p. (CONF-750915-18). Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden-Baden, F.R. Germany (10 Sep 1975).

High-rate sputter-deposition techniques were used to prepare supersaturated solid solution alloys for the normally immiscible Ta–Pu and Ag–Pu systems and to investigate the effect of substituting Pu for the rare-earth element in sputtered amorphous Co–Sm alloys. Two Ta–8 at. percent Pu deposits were prepared, which exhibited a unique two-phase bcc alpha-Ta and tetragonal beta-Ta structure. Both phases formed a metastable solid solution with the Pu resulting in an 0.85 percent increase in the alpha-Ta(a) parameter and a 1.5 percent increase in the beta-Ta(c) parameter. The metastable beta-Ta solid solution decomposed at a significantly lower temperature (less than 825°K) than the alpha-Ta solid solution (975°K). A Ag–0.5 at. percent Pu solid solution was obtained by co-sputtering the elements onto a liquid nitrogen cooled substrate. The solid solution was

retained to room temperature for x-ray diffraction studies. The lattice parameter of the Ag was expanded from 4.086 A to 4.091 A, representing a positive deviation from Vegard's law. A Co–11 at. percent Pu alloy (Pu_2Co_{17}) was sputter-deposited at 290°K for comparison with sputtered amorphous Sm_2Co_{17}. Both alloys formed a $CaCu_5$-type structure on annealing, with subsequent transformation to the equilibrium Th_2Zn_{17} (Co–Sm) and Th_2Ni_{17} (Co–Pu) structures. The deposition and annealing results indicate that the sputtered Co–Pu alloy has a microcrystalline structure. Results suggest that amorphous plutonium alloys equivalent to the sputtered amorphous rare-earth-transition metal series can be obtained by sputter-depositing plutonium-transition metal alloys with a higher Pu content. (auth)

1199 (INS-J-149) PREPARATION OF SELF-SUPPORTING ZINC TARGET FOILS OF SEPARATED ISOTOPES. Sugai, I. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 13 Jan 1975. 12p. Dep. NTIS (US Sales Only) $4.00.

A method is described for the preparation of self-supporting zinc foils from ZnO. The thicknesses of target foils and their uniformity were measured using an α thickness gage. (auth)

1200 (INIS-J-150) PREPARATION OF SELF SUPPORTING MAGNESIUM TARGET FILMS OF SEPARATED ISOTOPES. Sugai, I. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 13 Jan 1975. 15p. Dep. NTIS (US Sales Only) $4.00.

Research on methods of preparing Mg targets is reported. A method is described for the preparation of self-supporting magnesium foils from MgO. The thickness of target foils and their uniformity were measured using an α thickness gage. (auth)

1201 (INS-J-152) PREPARATION OF SELF-SUPPORTING METALLIC FOILS OF NICKEL ISOTOPES. Sugai, I. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 5 Jun 1975. 33p. Dep. NTIS (US Sales Only) $4.75.

Methods of target preparation for use in low energy nuclear experiments are reported. An electroplating method has been developed as a dependable and reproducible technique for making self-supporting metallic foils of nickel in the thickness range of 0.5 to 10 mg/cm^2. The procedures minimized the necessary amount of material so that nickel isotopes could be processed economically. Impurity contamination of the nickel foils during the electroplating process was less than 500 ppM, and the thickness variation in each foil was less than 3% of the central thickness. (auth)

1202 (N-75-20126) EFFECTS OF SHOCK WAVE COMPACTION ON THE TRANSITION TEMPERATURES OF A15 STRUCTURE SUPERCONDUCTORS. Final report. Otto, G. H. (Alabama Univ., Huntsville (USA). School of Graduate Studies and Research). Contract NAS8-30244. 51p. (NASA-CR-120708; UAH-RR-156). NTIS $4.25.

Several superconductors with the A15 structure exhibit a positive pressure coefficient, indicating that their transition temperatures increase with applied pressure. Powders of the composition Nb_3Al, Nb_3Ge, Nb_3(Al/sub 0.75/Ge/sub 0.25/), and V_3Si were compacted by explosive shock waves. The superconducting properties of these materials were measured before and after compaction and it was found that regardless of the sign of the pressure coefficient, the transition temperature is always lowered. The decrease in transition temperature is associated with a decrease in the particle diameter. The shock wave passage through a 3Nb : 1Ge powder mixture leads to the formation of at least one compound (probably Nb_5Ge_3). However, the formation of the A15 compound Nb_3Ge is not observed. Elemental niobium powder can be compacted by converging shock waves close to the expected value of the bulk density. Under special circumstances a partial remelting in the center of the sample is observed. (auth)

1203 (N-75-21313) PROCESS DEVELOPMENT FOR PRODUCING FINE-GRAIN CASTING IN SPACE. Final report. Gelles, S. H.; Malik, R. K. (Battelle Columbus Labs., Ohio (USA)). 10 Apr 1975. 68p. (NASA-CR-120739). NTIS $4.25.

Assessment of grain growth kinetics at temperatures near the melting point and investigation into the use of potential nucleating agents in combination with the naturally occurring BeO led to the definition of critical low-g experiments which would help to determine whether one or both of these possibilities are valid and whether space processing would be able to yield fine grain ingot beryllium. (auth)

1204 (WAPD-TM--1202) POROSITY IN WELDS. Marino, G. P. (Bettis Atomic Power Lab., West Mifflin, Pa. (USA)). Aug 1975. Contract E(36-1)-Gen-14. 27p. Dep. NTIS $4.50.

A theory for the formation of gas bubbles in liquid weld puddles resulting from gaseous impurities (hydrogen, water vapor, or nitrogen) in the shielding gas was developed. The analysis is based upon the thermodynamic requirements for gas bubble nucleation in liquids and presumes a gas supercharging mechanism into the liquid via dissociation of the polyatomic gas impurities in the plasma. Results are presented in graphical form which give the temperature and impurity level sufficient to cause porosity in the welding of zirconium, aluminum, and nickel. The graphs yield lower limits for impurity contents and are, therefore, conservative in their predictions. (auth)

1205 (WAPD-TM-1216) TEMPERATURE MEASUREMENTS IN A FREE BURNING ARC. Glickstein, S. S. (Bettis Atomic Power Lab., West Mifflin, Pa. (USA)). Sep 1975. Contract E(36-1)-GEN-14. 61p. Dep. NTIS $5.50.

Spectroscopic analysis of a 100-A gas tungsten arc welding arc indicates an arc temperature of 11000°K near the cathode, decreasing toward the anode to 8000°K. At these temperatures, the argon gas is approximately 2 percent ionized, and the electron density and conductivity of the gas are sensitive to small changes in arc temperature. The arc temperature with a stationary molten anode is similar to that with a cooled anode. Photographs of the arc indicate an expanding plasma region with increased arc current. The axial temperature at the arc midplane follows the equation T equals (7643 + 18.8 I)°K. (DLC)

1206 (Y-1998) CHARACTERIZATION OF THE URANIUM-2.25 WEIGHT PERCENT NIOBIUM ALLOY. Hemperly, V. C. (Oak Ridge Y-12 Plant, Tenn. (USA)). 15 Oct 1975. Contract W-7405-eng-26. 14p. Dep. NTIS $4.00.

A study was made of the methods for preparing, processing, and heat treating uranium-2.25 wt percent niobium alloys. The rolling technique is critical, but the alloy responds to conventional solution treatment, water quenching, and aging to provide high strength with good ductility. Data on tensile tests and Charpy tests as functions of the temperature have been obtained. Elastic moduli, density, coefficient of thermal expansion, and differential thermal analysis data have also been determined. (auth)

1207 SCANDIUM BEHAVIOR IN ZIRCONIUM CONCENTRATE SULPHATIZATION. Shavlo, R. A. Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 3, 101-102(1974). (In Russian).

For purifying zirconium concentrate from iron oxide, a sulfatization method is often used. After leaching of the sulfate cake with water, the zirconium concentrate is separated from soluble sulfates by filtration. For studying scandium behavior in the sulfatization of non-pulverized zirconium concentrates, such concentrates ground to –0.05 mm and non-pulverized sands were studied. The sulfatization agents used were H_2SO_4 and alkali metal pyrosulfates. The amount of scandium oxide extracted from the concentrates into solution depended on the nature of the sulfatization agent and the temperature regime of the process. Scandium oxide yields are given for temperatures from 200 to 670°C and for different sulfatization agents. (tr-INIS)

1208 SMELTING OF HAFNIUM AND SOME HAFNIUM BASE ALLOYS. Korkin, I. V.; Suvorov, A. M.; Butova, M. N. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 96-101 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

Two methods were studied for melting Hf and several Hf base alloys, fluidized state and electron beam methods. The technological and electrical parameters of the melt were determined. The nature of changes in the chemical composition of the alloys in the preparation process was demonstrated. (tr-auth)

1209 THE EXPERIMENTS ON PRODUCTION OF THIN-WALLED PIPES OF HAFNIUM BASE GTsN20-0.5 ALLOY. Kovalev, K. S.; Gridnev, A. N.; Suvorov, A. M.; Stankevich, A. N. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 101-106 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

The best possibility of producing tubes from Hf-base alloys was demonstrated. The basic temperature and processing regimes were established. (tr-auth)

1210 ELECTROLYTIC POLISHING OF NIOBIUM. Migai, L. L.; Arons, V. I. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 62-69 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

Literature data on compositions of electrolytes for polishing niobium were analyzed. Optimum regimes for polishing niobium in HF-H_2SO_4 electrolytes were determined. (tr-auth)

1211 ALLOY FOR ALLOYING. Oshchepkov, B. V.; Chekhomov, O. M.; Cheremnykh, B. A.; Sukharev, V. A.; Listkova, A. I. Stal; No. 7, 611(Jul 1974). (In Russian).

For English translation see the journal Stal USSR.

Instead of vacuum-induction-melted alloys, containing 9-20% Mo, 9-11% Nb, 50-72% Ni, and 6-20% Fe, used in alloying of some resistant Ni alloys, the use of such alloys in open electro melts in 0.5-t ingots was developed. In melts in a 5-t electro furnace, non-ferrous metal impurities from the initial charge were 44-96.5% eliminated. The quality of the alloy was not impaired. (tr-auth)

1212 MECHANISM OF SLAG SKIN ADHESION WELD SURFACE. Pokhodnya, I. K.; Yavdoshchin, I. R.; Karmanov, V. I.; Vojtkevich, V. G. (AN Ukrainskoj SSR, Kiev. Inst. Ehlektrosvarki). Avtomat. Svarka; No. 5, 5-9(May 1974). (In Russian).

For English translation see the journal Autom. Weld.

Using a resolving electron microscope and x-ray structural phase analysis, the effect of composition and structure of the slag and the peculiarities of formation of the separation boundaries of the metal and scale of a seam weld on the mechanism of their adhesion were studied. On welding of steel alloyed with Ti, Cr, V, at the metal-slag boundary, layers of compounds enriched in these elements form as a result of selective oxidation by the molten slag of elements having a higher affinity for oxygen than iron. For adhesion of the slag layer to the metal seam, the presence of an intermediate layer with crystal lattice parameters that ensure its epitaxial growth or texturing on the metal seam substrate is needed. In the absence of such a layer, formed by interaction of the constituents of the oxide slag, spinels do not lead to epitaxial adhesion of the slag layer to the seam metal even if the crystal lattice parameters are close to those of alpha-Fe or wuestite. Separability of the slag layer may be improved by changing the oxidation potential of the welding slag either to exclude formation of the intermediate layer or to obtain parameters of its crystal lattice which will eliminate the epitaxial growth of the layer on the seam surface. (tr-auth)

1213 NICKEL AND COBALT ALLOYING WITH TUNGSTEN BY ELECTROLYTIC DEPOSITION ON THE GRAPHITE FIBERS. Yagubets, A. N.; Sherstkina, V. N. Elektron. Obrab. Mater.; No. 5, 31-33(1974). (In Russian).

For English translation see the journal Appl. Electr. Phenom.

Good-quality Ni- and Co-W coatings were obtained on graphite fibers from an electrolyte containing hydrazine sulfate. Electron-microscope and x-ray structure studies showed these coatings, alloyed with small amounts of W, to be solid solutions. Large internal stresses, exceeding the stability limits of the alloy, were present in the coatings. The amount of tungsten in the coatings, determined quantitatively by forming the yellow-green pentavalent W complex with rhodonide, was 10-40%. (tr-auth)

1214 METALLOGRAPHY OF VANADIUM MONOCRYSTALS. Koltygin, V. M.; Desipri, A. I. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 129-135 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

Electrolytic polishing and etching of alumo-thermal (99.7 wt %) and electrolytic (99.9 wt %) V monocrystals were studied. The structure on different planes of the crystals was determined. (tr-auth)

1215 ELECTRIC SPARK MACHINING OF ZIRCONIUM ALLOYS. Kiperman, S. Ya.; Ganichev, P. A.; Povyshev, I. A. Elektron. Obrab. Mater.; No. 4, 12-13(1974). (In Russian).

For English translation see the journal Appl. Electr. Phenom.

A look is taken at the effect of modes of electrospark treatment on the surface quality of zirconium alloys. It was established that with increasing intensity of the modes of treatment a change in structure, phase composition and individual mechanical properties of the material takes place. (tr-auth)

1216 CHOOSING MATERIAL FOR GASKETS USED IN DIFFUSION WELDING OF HARD ALLOY VK WITH CARBON STEELS. Mukha, I. M.; Gnedova, S. V. Elektron. Obrab. Mater.; No. 4, 61-63(1974). (In Russian).

For English translation see the journal Appl. Electr. Phenom.

A study was made of the effect of activation-compensatory claddings on the weld strength during the diffusion welding of solid VK alloy with carbon steel. It is shown that welding compounds with complex compositions have the best strength characteristics in bend testing: Fe-Ni with 1 to 2 wt % WC, Fe-Ni with 2 wt % VKZ, and Fe-Ni with 2 wt % VK6. (tr-auth)

1217 PECULIARITIES OF CATHODE EROSION AND MATTER TRANSFER FROM CATHODE TO ANODE DURING ELECTRIC SPARK ALLOYING. Sychev, V. S.; Verkhoturov, A. D. Elektron. Obrab. Mater.; No. 4, 39-41(1974). (In Russian).

For English translation see the journal Appl. Electr. Phenom.

Studies were carried out on regularities in the change of erosion of cathode materials made of the transition metals of groups IV and V, and also in the amount of eroded cathode material depends on its thermophysical properties, and especially on its melting temperature. It was also established that on strengthening iron with titanium and zirconium in an argon atmosphere, the amount of material carried over from the cathode to the anode is comparable with the anodic erosion. (tr-auth)

1218 ON ZONE RECRYSTALLIZATION OF INDIUM. Bel'skij, A. A.; Nekrasova, E. A. Izv. Akad. Nauk SSSR, Metal.; No. 5, 46-50(Sep 1974). (In Russian).

For English translation see the journal Russ. Metall.

With silver as an example of an impurity a study was carried out of the effect of the intensity of electromagnetic agitation of a zone melt on the efficiency of the zone recrystallization of indium and on the character of the impurity distribution over the cross-section of the rod. The value of the effective distribution coefficient for silver ($K_{eff} < 1$) decreases with increasing potential of the traveling electromagnetic field H. This decrease is abrupt in character over a small interval of values of H equal to 15,000-20,000 a/M. A preferential enrichment of the lower part of the rod cross-section is noted on carrying out the zone recrystallization of indium without electromagnetic agitation of the zone melt. On application of the traveling electromagnetic field the distribution of silver impurity over the rod cross-section is more homogeneous. (tr-auth)

1219 ON FORMS OF CRYSTAL GROWTH OF ANTIMONY COMPOUNDS DURING BINARY ALLOYS CRYSTALLIZATION. Salli, I. V.; Dolinskaya, V. Z.; Samojlenko, L. V. Izv. Akad. Nauk SSSR, Metal.; No. 4, 188-193(Jul 1974). (In Russian).

For English translation see the journal Russ. Metall.

Crystal form is determined by the form of the crystal-liquid, interphase surface which may be planar or spherical. A study was made of the growth forms of semiconducting antimony compounds during crystallization of binary alloys of In-Sb and Cd-Sb. With an increase in the cooling rate and depending on the direction of heat removal (through the liquid, solid or liquid-solid phases), the interphase separation surface of the compounds under study was transformed from flat to round. The Jensen criterion, which does not take into account such factors as cooling rate and direction of heat removal, cannot be a universal criterion for predicting crystal growth forms. More suitable as a criterion of the stability of a plane-faced growth front is the following criterion K: $K = R_1/R_2$. Here $R_1 = T_c/(T_\alpha - T_K)$ and $R_2 = T_K/(T_K - T_\partial)$, where T_c is the supercooling temperature of the liquid solution; T_α is the liquidus temperature and T_K is the temperature at the crystal-liquid boundary. At $K < 1$ the crystals grow plane-faced; at $K > 1$ the crystals are round. If the removal of heat from the growing crystal takes place through the liquid, then $K < 1$. With removal of heat through the solid phase, $K > 1$. (tr-auth)

1220 HEATS OF FORMATION OF YTTRIUM-LEAD ALLOYS. Borsese, A.; Ferro, R.; Capelli, R.; Delfino, S. (Univ., Genoa). J. Less-Common Met.; 42: No. 2, 179-185(Sep 1975).

The heats of formation in the Y-Pb system were measured by using a differential direct isoperibol calorimeter. Compositions and the state of the samples were checked by chemical, metallographic and x-ray analyses. The following values (kcal/g-at.) were obtained for the various compounds (reaction in the solid state, ΔH_{300K}): $Y_5Pb_3 : \Delta H = -16.0 \pm 0.5$; $Y_5Pb_4 : \Delta H = -14.4 \pm 0.5$, $YPb_2 : \Delta H = -8.9 \pm 0.5$; $YPb_3 : \Delta H = -6.7 \pm 0.5$. These data have been compared with those obtained for the La-Pb and Y-Bi alloys and are discussed briefly in relation to the model suggested by Miedema [J. Less-Common Metals, 32 (1973) 117]. (auth)

1221 IMPROVEMENTS IN OR RELATING TO SUPERCONDUCTING MEMBERS AND METHODS OF MANUFACTURE THEREOF. Madson, P. E.; Charlesworth, J. P.; Armstrong, D. (to United Kingdom Atomic Energy Authority). British Patent 1,394,724/B/. 21 May 1975. Filed date 4 Aug 1972. 14p.

Reference is made to superconducting materials having comparatively high critical temperatures and critical magnetic fields. Such materials include compounds of A15 crystal structure having the general formula A_3B, where A is Nb or V and B is one or more of the elements Al, Ge, In, Si, Ge, and Sn. A method for manufacturing such materials is described in BP 1 333 554. The present specification is concerned with stabilization of materials manufactured by the method described in the earlier specification. By stabilization is here meant prevention or reduction of the undesirable effects of sudden movement of magnetic flux, known as flux jumps. Two methods of stabilization are combined in the same material, known respectively as filamentary stabilization, in which the superconducting material is present in the form of fine filaments in a normally conducting matrix, and dynamic stabilization, in which a proportion of the normally conducting matrix material takes the form of a material of high electric conductivity, such as pure Cu. (UK)

1222 WELDING OF AUSTENITIC STAINLESS STEELS FOR HIGH TEMPERATURE APPLICATION, 1968–1974. Cambridge, Eng.; Welding Inst. (1975). 13p.

Abstracts are provided of 45 papers on the welding of austenitic stainless steels for high temperature application (including papers on inspection, testing and mechanical properties of welds; and analysis of causes of failure of welds). (UK)

1223 NEUTRON-ABSORBING ALLOYS. Portnoi, K. I.; Arabei, L. B.; Gryaznov, G. M.; Levi, L. I.; Lunin, G. L.; Kozhukhov, V. M.; Markov, J. M.; Fedotov, M. E. British Patent 1,396,275/B/. 4 Jun 1975. Filed date 4 Jan 1974. 4p.

A process is described for the production of an alloy consisting of 1 to 20% In, 0.5 to 15% Sm, and from 3 to 18% Hf, the balance being Ni. Such alloys show a good absorption capacity for thermal and intermediate neutrons, good neutron capture efficiency, and good corrosion resistance, and find application in nuclear reactor automatic control and safety systems. The Hf provides for the maintenance of a reasonably high order of neutron capture efficiency throughout the lifetime of a reactor. The alloys are formed in a vacuum furnace operating with an inert gas atmosphere at 280 to 300 mm. Hg. They have a corrosion resistance higher than that of the Ag-based alloys commonly employed, and a higher neutron capture efficiency than Ag alloys. Castability and structural strength are good. (UK)

1224 ELECTROPRECIPITATION OF TUNGSTEN FROM MOLTEN ELECTROLYTES. Imamov, T. Kh.; Bazarov, R. N.; Nazarov, A. A. Dokl. Akad. Nauk Uzb. SSR; No. 1, 40-41(1975). (In Russian).

The optimum composition of the electrolyte was found to be in wt %: 70 $NaPO_3$ plus 30 NaCl. The maximum yield of tungsten metal according to current (60%) was obtained at a $CaWO_4$ (scheelite) content of 7 wt % and a temperature of 1050°C at an initial, cathode current density of 3000 A/m^2. On increasing the temperature to 1100°C the metal yield according to current fell to 38%. The metallic tungsten was 99.2% pure with impurities of 0.04 wt % C, 0.04 to 0.05 wt % O, and 0.015 to 0.021 wt % P. (SJR).

1225 METALLOGRAPHIC TECHNIQUES IN A MULTIDISCIPLINE STUDY OF A STAINLESS STEEL WELDMENT. King, R. T.; Berggren, R. G. (Oak Ridge National Lab., TN). pp 105-121 of Microstructural Science. Vol, III. French, P. M.; Gray, R. J.; McCall, J. L. (eds.). New York; American Elsevier Publishing Co., Inc. (1975).

The room-temperature tensile deformation of a whole cross section of a 60-mm-thick type 308 stainless steel weld was studied by brittle lacquer coating methods, photoelastic techniques, and post-test measurements. These methods are compared. Nonuniform deformation of the weldment was qualitatively explained on the basis of previous test data from small specimens that demonstrated nonuniformity of properties in the weld metal, heat-affected zone, and base metal and anisotropy of deformation in the weld metal proper. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 515, 785, 1102, 1119, 1137, 1346, 1447, 2051, 2055, 2059, 2275, and 2434.

1226 (AD/A-003552) STRUCTURE AND DECOMPOSITION OF TITANIUM AND ZIRCONIUM BCC SOLID SOLUTIONS. Final Report. Sass, S. L. (Cornell Univ., Ithaca, N. Y. (USA)). Dec 1974. Contract N00014-67-A-0077-0012. 23p. NTIS $3.25.

The structure, the mechanical properties, and the decomposition of Ti and Zr bcc (e.g. Zr-Nb, Ti-V) solid solutions were studied. The experimental techniques used in this study were electron microscopy, electron diffraction, elastic constant measurements and single crystal tensile testing. Highlights of the research are reviewed and important results are considered. (GRA)

1227 (AD/A-003954) INFLUENCE OF ENVIRONMENT ON CRACK BEHAVIOR. Final Report. Kramer, I. R. (Martin Marietta Aerospace, Denver, Colo. (USA)). Aug 1974. Contract F44620-74-C-0032. 23p. (MCR-74-143-F). NTIS $3.25.

See also report dated Apr 1974, AD-783337.

The analytical expressions presented in this report relate the crack velocity and the failure time to the surface-layer stress coefficient for compact-tension specimens of Ti-6Al-4V and a 4130 steel subjected to stress-corrosion cracking. The experimental data for the threshold stress intensity factor and the crack velocities for various stress intensity factors agree well with the calculated values. (GRA)

1228 (AD/A-004044) KINETIC INDUCTANCE IN THIN FILMS OF AMORPHOUS SUPERCONDUCTORS. Final Report, 1 February 1971–30 November 1974. Naugle, D. G. (Texas Agricultural and Mechanical Univ., College Station (USA)). 1975. 10p. NTIS $3.25.

Two major problems were studied experimentally during the course of these grants: (1) the behavior of the kinetic inductance in thin superconducting films, and (2) the influence of an adsorbed noble gas layer on the transition temperature of a superconducting Sn, Tl, Al, and Bi thin film. (GRA)

1229 (AD/A-004266) EUTECTIC ALLOY OPTIMIZATION PROGRAM. Final Report, 18 January–19 October 1974. Kraft, E. H. (United Aircraft Research Labs., East Hartford, Conn. (USA)). Dec 1974. Contract N62269-74-C-0321. 58p. (UARL-N-911824-3). NTIS $4.25.

The development of a eutectic alloy composed of two ductile phases has proceeded. Cobalt additions to the gamma-alpha (Ni-37 wt% Cr-18 wt% W-0.1 wt% Al) eutectic improved phase alignment and increased strength at both room and elevated temperatures. No effect of cobalt on phase equilibria was observed. The gamma phase was substantiated as face centered cubic (fcc), while the crystallography of the alpha phase remained uncertain. Improvement of 73C eutectics in stability in thermal cyclic environments was sought by alloying and study of the mechanism of damage. Additions of aluminum, iron, and nickel stabilized the fcc structure of the cobalt matrix of 73C eutectics, thus increasing stability in thermal cycling environments. Carbide size and volume fraction also had an influence on thermal cyclic stability, but their contribution was found to be less important than carbide perfection. (GRA)

1230 (AD/A-004586) MATERIALS RESEARCH IN SUPPORT OF SUPERCONDUCTING MACHINERY. II. Semiannual Technical Report No. 2, 1 March–1 September 1974. Clark, A. F.; Reed, R. P.; van Reuth, E. C. (National Bureau of Standards, Boulder, Colo. (USA)). Oct 1974. 787p. NTIS $17.25.

See also report dated Mar 1974, AD-780596.

The second semi-annual technical reports are collected from six subcontractors on an ARPA sponsored program on the very low temperature properties of structural materials in support of superconducting machinery. The program is outlined and research progress is reported. Low temperature data are presented for the elastic, tensile, fatigue, and fracture properties, thermal expansion, specific heat, thermal and magnetothermal conductivity, electrical and magnetic properties of structural alloys. Effects of processing, and fabrication are also reported for many of the properties; weld and braze joint properties are included. Low temperature properties for composites are reviewed and limited tensile and flexure data at 4K presented. (GRA)

1231 (AE-505) OBSERVATIONS ON DEFORMATION SYSTEMS IN ZIRCALOY-2 DEFORMED AT ROOM TEMPERATURE. Pettersson, K.; Bergqvist, H. (Aktiebolaget Atomenergi, Studsvik (Sweden)). Aug 1975. 21p. Dep. NTIS (US Sales Only) $4.25.

Different polycrystalline samples of Zircaloy-2 with textures such that the c-axis of most of the grains is oriented near the sheet normal were subjected to loading conditions such that sheet thinning was accomplished. Metallography showed that no twinning was involved. Electron microscopy showed the presence of $\langle c + a \rangle$ dislocations that were usually confined to deformation bands. With the help of stereo micrographs the most likely plane of slip was determined to be $\{10\bar{1}1\}$. The possibility of $\langle c + a \rangle$ slip as a means of breaking the oxide film in iodine induced stress corrosion cracking of Zircaloy-2 is briefly discussed. (auth)

1232 (AED-CONF-75-170-002) EXPERIMENTAL INVESTIGATIONS OF THE EQUILIBRIUM STATES IN bcc Fe-V ALLOYS. Ettwig, H. H.; Pepperhoff, W. (Mannesmann-Forschungsinstitut G.m.b.H., Duisburg (F. R. Germany)). 1975. 6p. (In German). INIS.

From general meeting of the Deutsche Gesellschaft fuer Metallkunde; Nuernberg, F. R. Germany (20 May 1975).

6 figs.

Data for the calculation of phase diagrams were determined experimentally for the system Fe-V. The range of experiments covers measurements of the specific heat to determine the B2-A2 transition temperature and transition heat, magnetic experiments with disordered and ordered (σ phase-free) Fe-V alloys to determine the concentration dependence of the Curie temperature, and Moessbauer experiments that allow statements on the ordered states. (GE)

1233 (AED-CONF-75-170-006) STRUCTURE AND MAGNETISM OF RARE EARTH METAL ALLOYS WITH RUTHENIUM, RHODIUM, AND PALLADIUM. Loebich, O. (Forschungsinstitut fuer Edelmetalle und Metallchemie, Schwaebisch Gmuend (F. R. Germany)). 1975. 7p. (In German). INIS.

From general meeting of the Deutsche Gesellschaft fuer Metallkunde; Nuernberg, F. R. Germany (20 May 1975).

9 figs.; 11 refs.

The phase diagrams of Gd-Ru, Gd-Rh, and Gd-Pd are explained. The paramagnetic Curie temperature curves of the systems Gd-Pd, Dy-Pd, Gd-Rh, Ge-Ru, and Dy-Ru and the susceptibility of the system Y-Rh are presented and explained. (GE)

1234 (AERE-R-6534) EFFECT OF HEAT TREATMENT ON THE SUPERCONDUCTING CRITICAL CURRENT OF COLD-WORKED TITANIUM–45 at. % NIOBIUM. Part I. Charlesworth, J. P.; Madsen, P. E. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Oct 1970. 52p. Dep. NTIS (US Sales Only) $5.75.

A study was made of the effect of heat treatment at temperatures up to 340°C on the superconducting critical currents of cold-worked titanium–45 at.% niobium wires. Analysis of the data suggests that for heat treatment times up to 8 hours at 290°C or 1 hour at 340°C the increase in critical current density reflects an underlying process with an activation energy of 1.55 ± 0.2 eV and a dependence on heat-treatment time t proportional to $t^{0.4}$. Possible mechanisms for the increase are discussed and it is suggested that a mechanism involving migration of interstitial impurity atoms to dislocation cell walls is consistent with the observed activation energy. A model of this process was developed, taking into account the cellular geometry of the dislocation structure, and predicts a dependence on $t^{0.4}$ in good agreement with the experimental results. The correlation of the observations with the estimated strength of the dislocation–impurity interaction is discussed and some tentative suggestions made as to the flux pinning mechanism relating the impurity migration to the critical current density. (22 fig., 64 references) (auth)

1235 (BNWL-SA-5324) MECHANICAL PROPERTIES OF ALPHA-NEPTUNIUM: HARDNESS AND ELASTIC MODULI. Merz, M. D.; Kjarmo, H. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 6p. (CONF-750915-17). Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden-Baden, F.R. Germany (10 Sep 1975).

A study of hardness and elastic moduli of alpha-neptunium was conducted. The hardnesses at 203, 240 and 298°K were 418, 395, and 346 dph, respectively. The high hardnesses were attributed to the low symmetry of alpha-neptunium and the large number of twins in the microstructure. Unusual deformation twinning and slip were observed near the hardness indentations. A second twinning mode, in addition to the reported (110) mode, was suggested by the observations. This twinning was characterized by very narrow, straight twins in contrast to the wide, highly curved twins observed previously in polycrystalline alpha-neptunium. An ultrasonic method was used to measure sound velocities at 77 to 373°K. Elastic moduli and Poisson's ratio were calculated from the sound velocities. The room temperature values for the moduli were: B equals 11.7 x 10^{11} dyne/cm^2; G equals 8.28 x 10^{11} dyne/cm^2; and sigma equals 0.22. The values were very nearly the same as the reported moduli of alpha-uranium. (auth)

1236 (BNWL-SA-5326) SOUND VELOCITY AND ELASTIC MODULI IN ALPHA-PLUTONIUM AT PRESSURES TO 50 KBAR. Merz, M. D.; Hammer, J. H.; Kjarmo, H. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 7p. (CONF-750915-19). Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden-Baden, F.R. Germany (10 Sep 1975).

The elastic moduli, bulk modulus, and shear modulus were measured in polycrystalline alpha-plutonium at pressures to 50 Kbar. An ultrasonic technique enabled measurement of both longitudinal and shear wave velocities in a girdled-piston high pressure cell. The average pressure derivatives were 14.3 and 4.3 m/s/kbar for the longitudinal and shear velocities, respectively. Bulk and shear moduli were calculated from the sound velocity data. The average pressure derivatives for the moduli were 14 and 3.5, respectively. Poisson's ratio was calculated directly from the ratio of longitudinal and shear velocities and increased from 0.17 at atmospheric pressure to 0.28 at 50 kbar. (auth)

1237 (BNWL-SA--5328) MICROSTRUCTURE AND KINETICS OF THE PLUTONIUM beta YIELDS alpha AND gamma YIELDS alpha TRANSFORMATIONS. Allen, R. P.; Arrow Smith, H. W. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract AT(45-1)-1830. 12p. (CONF-750915-16). Dep NTIS $4.00.

From fifth international conference on plutonium and other actinides; Baden-Baden, F. R. Germany (10 Sep 1975).

Supported-discharge cathodic etching and SEM examination techniques were developed for alpha-Pu and used to investigate the alpha microstructures formed by the beta/sub alpha/ yields alpha and beta/sub gamma/ yields alpha transformations in high-purity extruded Pu at low and high alpha-phase temperatures (beta/sub alpha/ and beta/sub gamma/ are beta formed from alpha and gamma, respectively). Low (200°K) beta/sub alpha/ yields alpha transformation temperatures produced alpha with a grain size that was finer than that of the original extruded alpha and substantially smaller than the grain size of the alpha formed from beta/sub gamma/. At high alpha-phase temperatures (343 to 370°K), beta/sub alpha/ transformed to alpha by the surface nucleation and inward growth of colonies of columnar alpha grains oriented radially with respect to the original nucleation site. The transformation kinetics could be correlated with the microstructural observations based on a correspondence between the long axes of the grains and the (010) direction of the monoclinic alpha-Pu structure. Significant changes in the size, shape, and orientation of the alpha grains were noted with increasing transformation temperature. Conversely, the grain size of the alpha formed from beta/sub gamma/ was essentially constant at all transformation temperatures. Metallographic evidence of the gamma yields alpha skip transformation or a significant change in the mode of the gamma yields alpha transformation was obtained by a comparison of the alpha microstructures produced by quenching gamma to high (362 to 368°K) and low (200°K) alpha-phase temperatures. (auth)

1238 (CONF-750915-13) ELECTRONIC ENERGY BAND STRUCTURE OF ACTINIDE METALS AND INTERMETALLICS. Koelling, D. D.; Freeman, A. J. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 19p. Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden-Baden, F. R. Germany (10 Sep 1975).

The behavior of the 5f electrons as the crucial factor in determining the electronic properties of materials containing actinides is discussed. Whether these electrons will be localized or itinerant depends on the relative size of the Coulomb correlation and the near-neighbor interaction (bandwidth) terms. Evidence from optical reflectivity and de Haas-van Alphen measurements which show that the f-states are itinerant in the light actinide metals is examined. The mechanisms by which this occurs are studied and it is shown that the dominant feature is a direct f-f interaction on neighboring sites. It is as a result of this dominance that correlations with actinide separation are found for the observed superconducting and magnetic properties. Since materials which appear as exceptions to this correlation are significant as systems where the direct f-f interaction is not the dominant term, we discuss, as illustrative examples, the $L1_2$ crystal structure materials involving uranium. The materials considered in detail are URh_3 and UIr_3 for which an experimental determination of the Fermi surface has been made. In these systems, the dominant interaction is found to be the formation of a d-f bond. (auth)

1239 (CONF-750915-14) deHAAS-vanALPEN EFFECT IN URh_3 AND UIr_3. Arko, A. J.; Brodsky, M. B.; Crabtree, G. W.; Karim, D.; Windmiller, L. R.; Ketterson, J. B. (Argonne National Lab., Ill. (USA)). Sep 1975. Contract W-31-109-Eng-38. 13p. Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden-Baden, F.R. Germany (10 Sep 1975).

Measurements of the deHaas-vanAlphen effect were performed in the intermetallic compounds URh_3 and UIr_3. Complex spectra were observed in both materials. Effective mass measurements were made for several orbits in URh_3 and values as large as 5.3 m_0 were observed. The relatively complete data in URh_3 are consistent with a complex multiply-connected Fermi surface which is in qualitative agreement with band structure calculations. The largest frequency branches in UIr_3 appear to have the same topology as their corresponding branches in URh_3. In addition, a number of closed low-mass surfaces exist in UIr_3 and are discussed in terms of the calculations for URh_3. (auth)

1240 (CONF-750915-15) CALORIMETRIC STUDY OF THE INTERMETALLIC COMPOUNDS UAl_2 AND $PuAl_2$. Trainor, R. J.; Brodsky, M. B.; Knapp, G. S. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-eng-38. 11p. Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden-Baden, F.R. Germany (10 Sep 1975).

Results of low temperature specific heat measurements are presented on the strongly paramagnetic intermetallic compounds UAl_2 and $PuAl_2$ in the temperature intervals 0.9 to 20°K, respectively. These compounds are characterized by very narrow 5f bands near the Fermi energy. The low-temperature properties of UAl_2 and $PuAl_2$ are dominated by long lived spin fluctuations within these narrow bands. In UAl_2 a nearly field-independent $T^3 \log T$ contribution dominates the specific heat below 10°K,

consistent with the predictions of ferromagnetic spin-fluctuation theory. The specific heat, static susceptibility, and electrical resistivity are mutually consistent with T/sub sf/ equals 25 +- 10^0K, where T/sub sf/ is the characteristic spin-fluctuation temperature of the system. Below 20^0K, the specific heat of $PuAl_2$ contains a very large linear term, C approximately equal to 260T (mJ/mole-^{0}K), which is approximately four times the magnitude of the measured susceptibility, when both quantities are expressed in the same units. The specific heat of $PuAl_2$ exhibits no anomalous behavior below 10^0K, where a resistivity anomaly has been previously observed. The properties of $PuAl_2$ are qualitatively discussed in terms of antiferromagnetic spin fluctuations. (auth)

1241 (COO-2128-11) POSITRON LIFETIME MEASUREMENTS AS A NON-DESTRUCTIVE TECHNIQUE TO MONITOR FATIGUE DAMAGE. Byrne, J. G. (Utah Univ., Salt Lake City (USA), Div. of Materials Science and Engineering). Sep 1975. Contract E(11-1)-2128. 35p. (UTEC-75-130). Dep. NTIS $4.75.

In the fatigue cycling of initially hard copper, self consistent positron lifetime and x-ray particle size measurements followed the softening process and revealed a new feature which may be the final development of microvoids before fracture. In the cyclic fatigue of initially soft 4340 steel closely spaced concurrent measurements of these parameters are now in progress. For initially hard 4340 steel fatigue softening was revealed with a large positron lifetime decrease. In hydrogen embrittlement studies positron lifetime was found to be sensitive to hydrogen in an interesting way, i.e., if a specimen is already at its maximum defect density, hydrogen is trapped at some of the defects, reduce their attraction for positrons and hence cause a decrease in positron lifetime; conversely in a soft specimen, hydrogen generates more dislocation length than it can trap at (thus cancelling) hence a positron lifetime increase occurs. In electron irradiated and annealed single crystal copper 4 annealing peaks were seen at 125, 270, 400, and 650^0K. A clear correlation between decreasing positron lifetime and increasing percent porosity in alpha alumina was established. This behavior is quite the opposite to that in metals. (auth)

1242 (DESY-SR-75/04) $L_{2,3}$ TRANSITIONS IN LIQUID Na AND Al: EDGE SINGULARITY AND EXAFS STRUCTURES. Petersen, H.; Kunz, C. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). May 1975. 5p. INIS.

The $L_{2,3}$ excitation spectra in liquid Na and Al and in solid samples at several temperatures were measured with yield spectroscopy. The spike at the Na edge at about 31 eV is observed virtually unchanged in the liquid. This is in support of a many-body interpretation. The broader structures up to 100 eV above the edges in Na and Al are washed out in the liquid. This is in qualitative agreement with an EXAFS interpretation (extended absorption fine structure). (auth)

1243 (ERDA-tr-48) EXPERIMENTAL RESEARCH ON STRENGTH DESIGN CRITERIA TAKING INTO CONSIDERATION FATIGUE AND CREEP INTERACTION OF NUCLEAR REACTOR MATERIALS. Feb 1975. Translation of Japanese report. (JPNRSR-14). 225p. Dep. NTIS $7.60.

Interactions between fatigue and creep, and the rachet deformation mechanism were studied on SUS 316 stainless steel. The first phase included static tensile, creep rupture, strain rate effect, strain hold, load hold, and relaxation tests. The rachetting studies covered a three-rod model test and a fixed internal pressure-cyclic axial force test. (DLC)

1244 (IS-T-684) APPLICATION OF SOFT X-RAY APPEARANCE POTENTIAL SPECTROSCOPY TO LIGHT LANTHANIDES, 4d TRANSITION METALS, AND INSULATORS. Smith, R. J. (Ames Lab., Iowa (USA)). Oct 1975. Contract W-7405-eng-82. 216p. Dep. NTIS $14.00.

Thesis.

Evaporated films of La, Ce, Yb, Y, Ag-Mn(5 percent), KCl, MnF_2, CsCl and LaF_3 were studied using the soft x-ray appearance potential spectroscopy (SXAPS) technique. Studies were also made of bulk polycrystalline samples of Y, Zr, Nb, and Mo. The results are discussed in terms of existing SXAPS theories. Several similarities between soft x-ray absorption (SXA) data and the SXAPS results are discussed, and it is shown that the SXA data can aid in the interpretation of SXAPS spectra when using the well-known self-convolution model. In this approximation the absorption coefficient, alpha(E), is substituted for the density of states, N(E-E/sub c/) yields alpha(E). For more localized excitations, a convolution of alpha(E) with bremsstrahlung isochromat data, based on Wendin's two density of states formalism is used to predict SNAPS results. (auth)

1245 (IS-T-693) THERMAL CONDUCTIVITY OF HIGH PURITY VANADIUM. Jung, W. D. (Ames Lab., Iowa (USA)). Oct 1975. Contract W-7405-eng-82. 110p. Dep. NTIS $8.50.

Thesis.

The thermal conductivity, Seebeck coefficient, and electrical resistivity of four high purity vanadium samples have been measured as functions of temperature over the temperature range 5 to 300^0K. The highest purity sample had a resistance ratio (rho/sub 273^0K//rho/sub 4.2^0K/) of 1524. The highest purity sample had a thermal conductivity maximum of 920 W/mK at 9^0K and had a thermal conductivity of 35 W/mK at room temperature. At low temperatures the thermal resistivity was limited by the scattering of electrons by impurities and phonons. The thermal resistivity of vanadium departed from Matthiessen's rule at low temperatures. The electrical resistivity and Seebeck coefficient of high purity vanadium showed no anomalous behavior above 130^0K. The intrinsic electrical resistivity at low temperatures was due primarily to interband scattering of electrons. The Seebeck coefficient was positive from 10 to 240^0K and had a maximum which was dependent upon sample purity. (auth)

1246 (IS-T-696) OPTICAL PROPERTIES OF Nb-Mo AND OTHER ALLOYS OF Nb WITH ITS NEAREST NEIGHBORS IN THE PERIODIC TABLE. Black, E. S. (Ames Lab., Iowa (USA)). Oct 1975. Contract W-7405-eng-82. 46p. Dep. NTIS $5.50.

Thesis.

Optical properties of Nb alloys were investigated. Calorimetric measurements of absorptivity between 0.2 and 5.5 eV were taken for Nb samples with 20, 50, and 80 percent Mo and for Nb samples containing 10 percent Zr, 20 percent V, and 20 percent Ta. Reflectivity data for two of these samples in the ultraviolet region and known reflectivities for the pure metals to 35 eV provided the basis for extrapolation to high energies. The data were Kramers-Kronig analyzed to determine the dielectric function. The structure is discussed in terms of interband transitions as predicted by a rigid band model for the NbMo alloys. (auth)

1247 (JUL-1211) DIFFUSION OF HYDROGEN IN METALS. Kehr, K. W. (Kernforschungsaniage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Festkoerperforschung). Jun 1975. 159p. (In German). Dep. NTIS (US Sales Only) $7.75

Thesis. Submitted to Univ. of Cologne.

In this review, the theoretical picture of the diffusion of light interstitials is presented and compared with experiment. Possible quantum effects are discussed. Experimental results for the diffusion constants of H, D, and T in low concentrations in the transition metals V, Nb, Ta, Ni, and Pd are reviewed. Relevant interactions are introduced, and the problem of the localization of the hydrogen atoms is considered. Classical and quantum-mechanical theories of the single jumps of interstitials are presented. The quantum-mechanical modification of the classical rate theory is consistent with the results for the jump rate of the hydrogen atoms above room temperature. The theory yields both an isotope effect in the activation energy and, in the bcc metals, a universal prefactor in the Arrhenius law for the diffusion constant. On the other hand the completely quantum-mechanical hopping theory cannot quantitatively explain the experimental results above room temperature. Several extensions of theories of the diffusion of light interstitials are examined. Information which can be obtained from quasielastic incoherent neutron scattering is considered. The model of individual jumps between the octahedral sites is appropriate for fcc Pd, but in bcc metals the jump model has not been clearly confirmed. Information about the spatial distribution of a single proton can be obtained from the intensity of the quasielastic line. The intensity to be expected from "tunneling states" in which the protons are distributed quantum-mechanically over several sites is considered. The experimental results at room temperature agree with the picture that the protons essentially perform zero-point oscillations about their equilibrium positions. At higher temperatures, anomalies occur in the form factor of a proton. These anomalies indicate that the picture of fast, uncorrelated jumps between equilibrium sites becomes increasingly poorer at higher temperatures. A model which includes a partial delocalization of the proton increasing with increasing temperature is discussed. (DLC)

1248 (N-75-14883) EFFECTS OF ALLOY COMPOSITION IN ALLEVIATING EMBRITTLEMENT PROBLEMS ASSOCIATED WITH THE TANTALUM ALLOY T-111. Stephens, J. R. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Jan 1975. 40p. (NASA-TN-D-7838; E-7880). NTIS $3.75.

The causes of aging embrittlement in T-111 (Ta-8W-2Hf) and the effect of alloy modification were investigated. Results show that T-111 possesses a critical combination of tungsten and hafnium that leads to loss in ductility at -196^0C after aging near 1040^0C. It was found that this occurs because tungsten enhances

hafnium segregation to grain boundaries, which also leads to increased susceptibility to hydrogen embrittlement. Aging embrittlement was not observed in tantalum alloys with reduced tungsten or hafnium contents; most of the alloys studied have lower strengths than T-111 and exhibit susceptibility to hydrogen embrittlement. (STAR)

1249 (N-75-14888) ROLE OF ELECTRON CONCENTRATION IN SOFTENING AND HARDENING OF TERNARY MOLYBDENUM ALLOYS. Stephens, J. R.; Witzke, W. R. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Jan 1975. 23p. (NASA-TN-D-7893; E-8101). NTIS $3.25.

Effects of various combinations of hafnium, tantalum, rhenium, osmium, iridium, and platinum in ternary molybdenum alloys on alloy softening and hardening were determined. Hardness tests were conducted at four test temperatures over the temperature range 77 to 411^{0}K. Results showed that hardness data for ternary molybdenum alloys could be correlated with anticipated results from binary data based upon expressions involving the number of s and d electrons contributed by the solute elements. The correlation indicated that electron concentration plays a dominant role in controlling the hardness of ternary molybdenum alloys. (STAR)

1250 (N-75-16660) DEVELOPMENT OF ADVANCED HIGH STRENGTH TANTALUM BASE ALLOYS. Part 2. Scale-up Investigation. Final Report. Ammon, R. L.; Buckman, R. W. Jr. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1970. 60p. (NASA-CR-120931; WANL-M-FR-72-001-Pt-2). NTIS $4.25.

Three experimental tantalum alloy compositions containing 14–16 percent W, 1 percent Re, 0.7 percent Hf, 0.025 percent C or 0.015 percent C and 0.015 percent N were prepared as two inch diameter ingots by consumable electrode vacuum arc melting. The as-cast ingots were processed by extrusion and swaging to one inch and 0.4 inch diameter rod and evaluated. Excellent high temperature forging behavior was exhibited by all three compositions. Creep strength at 2000 to 2400^{0}F was enhanced by higher tungsten additions as well as substitution of nitrogen for carbon. Weldability of all three compositions was determined to be adequate. Room temperature ductility was retained in the advanced tantalum alloy compositions as well as a notched/unnotched strength ratio of 1.4 for a notched bar having K sub t equals 2.9. (auth)

1251 (N-75-20523) TENSILE AND CREEP PROPERTIES OF TITANIUM–VANADIUM, TITANIUM–MOLYBDENUM, AND TITANIUM–NIOBIUM ALLOYS. Gray, H. R. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Apr 1975. 30p. (NASA-TM-X-3216; E-8187). NTIS $3.75.

Tensile and creep properties of experimental beta-titanium alloys were determined. Titanium–vanadium alloys had substantially greater tensile and creep strength than the titanium–niobium and titanium–molybdenum alloys tested. Specific tensile strengths of several titanium–vanadium–aluminium–silicon alloys were equivalent or superior to those of commercial titanium alloys to temperatures of 650^{0}C. The Ti–50V–3Al–1Si alloy had the best balance of tensile strength, creep strength, and metallurgical stability. Its 500^{0}C creep strength was far superior to that of a widely used commercial titanium alloy, Ti–6Al–4V, and almost equivalent to that of newly developed commercial titanium alloys. (auth)

1252 (N-75-22427) COMPOSITIONAL EFFECTS ON MECHANICAL PROPERTIES OF HAFNIUM-CARBIDE-STRENGTHENED MOLYBDENUM ALLOYS. Witzke, W. R. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). May 1975. 34p. (NASA-TM-X-3239; E-8221). NTIS $3.75.

The mechanical properties of swaged rod thermomechanically processed from arc melted Mo–2Re–Hf–C alloys containing as much as 0.9-mol percent HfC were evaluated. The low-temperature ductilities of these alloys were not influenced by the amount of HfC present but by the amount of Hf in excess of stoichiometry. Maximum ductility occurred at 0.2- to 0.3-at. percent excess Hf. At 0.3- to 0.5-mol percent HfC, alloy strength varied directly with the Mo content of extracted carbide particles, both decreasing as the amount of excess Hf increased. Additions of 2-at. percent Re had little effect on strength or ductility. Tensile and creep strengths of Mo–2Re–0.7Hf–0.5C alloy equaled or exceeded those of other high strength Mo alloys. (auth)

1253 (NRL-7912) EVALUATION OF FATIGUE CRACK-GROWTH-RATE DETERMINATION USING A CRACK-OPENING-DISPLACEMENT TECHNIQUE FOR CRACK-LENGTH MEASUREMENT. Sullivan, A. M.; Crooker, T. W. (Naval Research Lab., Washington, D. C. (USA)). 12 Sep 1975. 30p. Office of Naval Research, Washington, DC.

Evaluation of a crack-opening-displacement (COD) technique for measurement of crack length in compact tension (CT) specimens for the determination of fatigue crack growth rate (FCGR) has proved it to be successful. Comparisons of COD-determined FCGR data with previously established trend lines for two high-strength steels (5Ni-Cr-Mo and 10Ni) are presented together with data from aluminum alloy 2024-T351. (auth)

1254 (ORO--2036-26) ATOMIC DIFFUSION AND POINT DEFECTS IN CRYSTALS. Final Report. Progress Report, April 1, 1956--August 31, 1972. Slifkin, L. M. (North Carolina Univ., Chapel Hill (USA)). 1972. Contract AT(40-1)-2036. 14p. Dep. NTIS $4.00.

Studies were made to elucidate the fundamental mechanisms of point defect transport in simple metals and in crystals of the silver halides. Experiments performed include: (a) effect of composition on diffusion in Ag-Au alloys and Ag-Cd alloys; (b) effect of a vacancy flux on diffusion; (c) diffusion of solutes in aluminum and its dilute alloys; (d) dislocation effects in Cu_3Au; (e) role of electronic structure and ionic radius in diffusion of cations in AgCl; (f) effects of ionic radius on halide impurity ion diffusion in AgCl and AgBr; (g) production of excess point defects in AgCl by deformation and by quenching; (h) the kinetics of the pinning of dislocations by point defects in AgBr crystals. (auth)

1255 (RCN–230) MAGNETIC ORDER IN COMPOUNDS BETWEEN THORIUM AND IRON. Elemans, J. B. A. A. (Stichting Reactor Centrum Nederland, Petten). Aug 1975. 102p. Dep. NTIS (US Sales Only) $8.25.

Thesis. Submitted to Leiden State Univ.

Neutron diffraction results are described for $Th(Fe,Co)_5$, $Th(Fe,Ni)_5$, $Th(Co,Ni)_5$, $ThFe_3$, and Th_2Fe_7. A reinterpretation of literature diffraction data on hexagonal R_2Fe_{17} compounds is given, with application to Tm_2Fe_{17}. (auth)

1256 (RDT-M-1-22T(9-75)) 2-1/4-PERCENT-CHROMIUM, 1-PERCENT-MOLYBDENUM ALLOY ELECTRODES AND FLUXES FOR SUBMERGED ARC WELDING. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Reactor Research and Development). Sep 1975 7p. RSO.

A standard prescribing requirements for 2¼ percent Cr–1 percent Mo alloy electrodes and fluxes for submerged arc welding for nuclear and associated applications is presented. (JRD)

1257 (RDT-M-4-4T(10-75)) ALLOY STEEL CASTINGS, (ASME SA-217 WITH ADDITIONAL REQUIREMENTS). (Oak Ridge National Lab., Tenn. (USA)). 17 Oct 1975. RSO.

A standard prescribing requirements for alloy steel castings (ASME SA-217 with additional requirements), for nuclear and associated applications is presented. This standard supersedes RDTM4-4T, dated July 1971. (JRD)

1258 (RL–75-060) SUPERCONDUCTING MATERIALS: SOME RECENT DEVELOPMENTS. Wilson, M. N. (Science Research Council, Chilton (UK). Rutherford Lab.). 1975. 14p. (CONF-750438–7). Dep. NTIS (US Sales Only) $4.00.

From 5th international conference on magnet technology; Frascati, Italy (21 Apr 1975).

This review concentrates on four subject areas which have seen significant changes in recent years: ac losses, stability, multifilamentary Nb_3Sn, and multifilamentary V_3Ga. Several applications are now being considered in which a small amplitude ac field is superposed on a larger dc field; fine filaments may not always give the lowest hysteresis loss under these conditions. The theory of self field instability has recently been improved and extended to the point where it can provide a good picture of the instability process under realistic thermal conditions. Some points of disagreement with experimental observation remain; however, a possible explanation is offered for this. Multifilamentary Nb_3Sn and V_3Ga are now reaching the stage of meriting serious consideration as fully practical magnet conductors. The remaining problems of production and utilization are being solved and composites have been tested with at least twice the overall current density of filamentary NbTi at all field levels. (auth)

1259 (WARD-HT-3045-9) BASIC CREEP-RUPTURE TESTING AT 1100^{0}F (593^{0}C) OF UNIAXIALLY LOADED SPECIMENS WITH UNIFORM SECTIONS OF TYPE 304 STAINLESS STEEL. Manjoine, M. J. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Jul 1975. Contract E(11-1)-3045. 268p. AT.

The tests were performed at 1100^{0}F in air on flat uniform gage section models of 304 ss which were uniaxially loaded. Three degrees of plane strain were obtained by laterally constraining the ends and varying the length-to-width ratio. Constant-load tests show that increasing the degree of plane strain will decrease the

creep rate, increase the creep strength, and decrease the instability strain at a given creep rate. In interspersed creep straining under increasing step loading, the strain and thermal history are critical: the creep rate is increased, strain rate sensitivity is increased so that the short-time loading strain is decreased, and the instability strain is increased with possibly longer rupture life. Strain distributions were measured. Strain instability is a function of triaxiality and strain rate. A damage criterion is proposed. (103 figures, 11 tables) (DLC)

1260 PROPERTIES OF EP590 ALLOY SMELTED BY DIFFERENT TECHNOLOGICAL PROCESSES. Tsvetkova, V. K.; Zimina, L. N.; Topilin, V. V.; Stepanov, V. P.; Dzugutov, M. Ya. Stal; No. 7, 641-643(Jul 1974). (In Russian).

For English translation see the journal Stal USSR.

The mechanical properties (from -196°C to hot deformation temperatures) and chemical properties and the effect of nonmetallic inclusions and of non-ferrous metals and gases on the strength of alloy EP590 (17.4% Cr, 2.6% Ti, 1.1% Al, 8.6% Mo, 1.9% W) were studied at Electrosteel and TsN11ChM under conditions of open induction melts and exposed to vacuum-arc and plasma-arc remelting. The sensitivity of samples of different melts to stress (0.1-mm-radius cuts, cracks) was analyzed. The two methods of remelting appeared to be equally promising, based on the various properties. (tr-auth)

1261 MUTUAL DIFFUSION OF NIOBIUM AND MOLYBDENUM. Vergasova, L. L. Tekhnol. Legk. Splavov.; No. 4, 43-47(1974). (In Russian).

Coefficients of mutual diffusion of Nb and Mo, calculated from concentration curves and activation energies, are given for temperatures of 1100-1150°C. A correlation between diffusion and resistance properties of Nb-Mo alloys is demonstrated. The mutual diffusion coefficient was affected by Mo additives. The activation energy of mutual diffusion did not change with composition of the alloy. (tr-INIS)

1262 X-RAY STRUCTURAL INVESTIGATION INTO THE FINE STRUCTURE OF DEFORMED ZIRCONIUM. Voskresenskaya, L. A.; Petukhova, A. S. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 5-8 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

By harmonic analysis of the profile of lines in an x-ray diffractometer (DRON-1) the change in the effect of micro stresses and of the fields of congruent dispersion of polycrystalline zirconium was studied as a function of the degree of deformation in rolling and according to depth of the samples. A decrease in the congruent dispersion field with increase in the degree of deformation and increase in micro stresses to a deformation of about 20% was noted. (tr-auth)

1263 MECHANICAL AND PHYSICAL PROPERTIES OF THE TANTALUM-TUNGSTEN ALLOY SYSTEM. Suvorov, A. M.; Kovalev, K. S.; Pauller, G. G.; Rumyantsev, A. V. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 32-37 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

Mechanical and physical properties of Ta-W alloys were studied over a wide temperature range. Melting of ingots in electron furnaces with temperature control gave alloys with high stability properties. (tr-auth)

1264 MECHANICAL PROPERTIES OF ORIENTED TUNGSTEN MONOCRYSTALS. Shishkov, V. V.; Strigina, N. I. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 124-129 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

Studies were made on the strength of W monocrystals as a function of purity of the starting material and direction of growth. The viscosity limit was determined from bending and hardness tests by the Vickers method with different placements of the identor on the crystallographic planes. The results showed hardness is determined by the structure of the crystallographic plane and the location of the pointer on it. The hardness anisotropy was related not only to the crystal lattice but also to the distribution of impurities in the growth of crystals in different directions. (tr-auth)

1265 ON THE STRUCTURE OF TUNGSTEN MONOCRYSTALS PREPARED BY ELECTRON ZONE MELTING WITHOUT CRUCIBLES. Sidokhin, E. F.; Chupyatova, L. P.; Pikunov, M. V. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 111-120 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

X-ray diffraction topography was used to study the block and dislocation structure of W monocrystals. Using zero contrast conditions, Burgess vector analyses were made and the nature of the distribution of dislocations in crystals of different orientation was determined. Based on the results, tests were made to establish the mechanism of formation of blocks of different types. (tr-auth)

1266 STRUCTURE AND PROPERTIES OF MOLYBDENUM WELDED IN OXIDATION ATMOSPHERE. Nerodenko, M. M.; Zabolotin, S. P.; Lizunov, V. A.; Minakov, V. N.; Trefilov, V. I. (AN Ukrainskoj SSR, Kiev. Inst. Metallofiziki); Morgunova, N. N.; Vorontsova, T. V. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Chernoj Metallurgii, Moscow (USSR)). Avtomat. Svarka; No. 8, 25-27(Aug 1974). (In Russian).

For English translation see the journal Autom. Weld.

The effect of oxygen in a protective helium atmosphere on the structure and properties of weld compounds of Mo was studied. With an optimum ratio of C to basic metal and oxygen concentration in the welding atmosphere, the plasticity of the seam metal increased due to the redistribution of impurities at the boundaries and in the body of the grains. (tr-auth)

1267 PROPERTIES OF SILVER-SAMARIUM ALLOYS. Mashkova, V. M. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 59-61 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

The effect of alloying additives of samarium on recrystallization temperature and mechanical and electrical properties of silver was studied. The temperature at which recrystallization started in Ag-2% Sm started was 250°C. Addition of Sm increased the hardness and resistance of the silver. Electrical conductivity of silver sharply decreased with increase in the amount of Sm added. (tr-auth)

1268 STUDY OF TECHNOLOGICAL PLASTICITY AND RESISTANCE TO DEFORMATION OF VN2 AND VN2AEh NIOBIUM BASE ALLOYS. Chizhov, I. N.; Skorkina, A. V.; Volin, Eh. M.; Demkin, V. L. Tekhnol. Legk. Splavov.; No. 4, 40-43 (1974). (In Russian).

The plasticity of ingots of Nb alloys (VN2 and VN2AE) was studied at 200 to 1400°C using methods of free precipitation and rolling of flat and wedge-shaped samples. The dependence of the resistance to deformation on the degree and temperature of rolling was determined. (tr-auth)

1269 INVESTIGATION ON THERMODYNAMIC PROPERTIES OF IRON-MOLYBDENUM ALLOY. Bokshtejn, B. S.; Bronfin, M. B.; Nikol'skii, G. S. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 7, 111-113(1974). (In Russian).

For English translation see the journal Stal USSR.

The Langmuir method was used to study the thermodynamic properties of the dilute solid solution Fe + 1.13 at. % Mo at 950 to 1200°C. A negative deviation from Pauli's law, which resulted in local close ordering, was demonstrated. (tr-auth)

1270 SAMARIUM DEFORMATION. Spasskaya, A. A.; Agapov, R. A.; Morozov, G. G.; Fomin, B. A. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 107-110 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

Testing of the mechanical properties at temperatures from 20 to 900°C was used to study the deformation capacity of samarium. The rolling regime (700 to 750°C) in air and the recrystallization annealing temperature interval (500 to 600°C) were found. (tr-auth)

1271 NEUTRON BEAM RESEARCH IN INDIA. Bhatnagar Prize-Winner Dr. P. K. Iyengar's Contributions. Anon. CSIR (Counc. Sci. Ind. Res.) News (India).; 24; No. 13, 100-102(15 Jul 1974).

Comprehensive programs were developed at the Bhabha Atomic Research Center, Trombay, for basic research in material sciences using neutrons and major contributions were made to the understanding of the solid state phenomena. The significant areas include: (1) studies on the magnetic ordering in ferro and antiferromagnetic materials and similar non-collinear spin structures; (2) studies on lattice dynamics in magnesium, zinc, and beryllium and (3) studies on the rotational motions of molecules in several crystals such as ammonium halides, lithium sulfate etc. (INIS)

1272 INVESTIGATION INTO LANTHANUM MICROSTRUCTURE. Dontsov, S. N.; Mel'nikova, L. V.; Voskresenskaya,

L. A.; Petukhova, A. S.; Moiseeva, I. S. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 8-18 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

Methods for preparing sections are described in detail. Corrosion was selected for exposing the phases. Metallographic and x-ray analysis methods were used to demonstrate five phases in lanthanum, differing in color, shape, and location of the grains. Two of these phases were identified as lanthanum nitrate and lanthanum sesquioxide in the cubic modification. (tr-auth)

1273 ON NON-METALLIC INCLUSIONS IN TUNGSTEN MONOCRYSTALS. Shishkov, V. V.; Pikunov, M. V.; Bondarenko, E. A.; Strigina, N. I. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Redkometallicheskoj Promyshlennosti, Moscow (USSR)). pp v. 57 p. 120-124 of Proceedings of the Institute. Investigation Into Rare Metal Alloys. Moscow; Metallurgiya (1974). (In Russian).

Electron-microscope studies were made of nonmetallic inclusions in W monocrystals, obtained by electron zone melting (no crucible). Crystalline and amorphous inclusions were studied. Inclusions recovered with carbon replicas from non-etched sections were circular. This indicates that the inclusions existed in the liquid metal. The high resistance of foreign inclusions in molten W under the zone melting conditions used is explained by the action of surface tension forces and the small size of the inclusions. (tr-auth)

1274 EFFECT OF HIGH-FREQUENCY ELECTRIC FIELD ON THE p-InSb PARAMETERS. Tyul'kov, G. I.; Petrov, A. S.; Solov'ev, Yu. L.; Butkov, V. V. (Tomskij Gosudarstvennyj Univ. (USSR). Sibirskij Fiziko-Tekhnicheskij Inst.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 10, 80-83(Oct 1974). (In Russian).

For English translation see the journal Sov. Phys. J.

By a contact-free, high-frequency resonator method a study was made of the effect of an electric field on the conductivity and lifetime of nonequilibrium current carriers in p-InSb at a temperature of 80°K. The observed increase in conductivity of p-InSb on application of the electric field is explained by an increase in carrier concentration as a result of shock ionization, while the change in lifetime of nonequilibrium carriers is explained by charge transfer of recombination centers. (tr-SJR)

1275 THE WAYS OF DECREASING THE WEAR OF AN ELECTRODE-TOOL DURING ELECTRIC SPARK MACHINING OF CONDUCTIVE MATERIALS. Review. Frolov, V. K. Elektron. Obrab. Mater.; No. 4, 5-9(1974). (In Russian).

For English translation see the journal Appl. Electr. Phenom.

A review is presented of the results of studies carried out by scientists of various countries over the last 10 to 15 years in the field of electroerosion treatment with the least wear of the electrode tool. A discussion is presented of problems associated with the selection of erosion-stable materials for the electrode tool, of methods of making these materials, and also of the problem of the effect of the dielectric medium on wear of the electrode which is being treated. A presentation is given of electrical schematic diagrams, of equipment and devices for decreasing wear of the electrode tool and of optimum modes of treating machine parts with the least wear of the electrode. (tr-auth)

1276 PHASE EQUILIBRIUMS IN ALLOYS OF NIOBIUM-ZIRCONIUM NITRIDE QUASI-BINARY SECTION. Ban'kovskij, O. I.; Gordeeva, T. I.; Moiseev, V. F.; Pechkovskij, Eh. P.; Trefilov, V. I. Izv. Akad. Nauk SSSR, Metal.; No. 4, 198-203 (Jul 1974). (In Russian).

For English translation see the journal Russ. Metall.

By calculating the limiting solubility of nitrogen in a solid solution of niobium alloys of the quasibinary section Nb-ZrN it is shown that the calculations made by starting from one or a number of experimentally determined values of the concentration show sufficient accuracy that they can take the place of detailed studies required for the experimental determination of the limiting solubility. Conditions of equilibrium are considered between a solid alpha-solution of quasibinary alloys in the Nb-ZrN system and a nitride phase, and also between the solid solution and nitrogen in the gaseous atmosphere. Expressions are obtained for the concentration of nitrogen in a solid solution of the alloys as a function of temperature and partial pressure of nitrogen. With a thermal vacuum treatment (annealing in a temperature interval from 900 to 1900°C in a vacuum of $\sim 5 \times 10^{-4}$ tor) conditions can be realized that lead to the structural instability of two-phase, niobium alloys containing zirconium nitride. In this case the concentration of nitrogen in the solid alpha-solution is substantially below the limiting solubility; dissociation of the second phase takes place, and nitrogen is emitted from the alloy. (tr-auth)

1277 VISCOSITY PARAMETERS OF COMPOSITE LIQUID ALLOYS. Arsent'ev, P. P.; Vinogradov, B. G.; Shmyrev, A. I.; Krupichev, A. K.; Gavrikov, N. V. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 9, 17-21(1974). (In Russian).

For English translation see the journal Stal USSR.

By a torsion-oscillatory method in an atmosphere of purified helium, measurements were taken of the viscosity characteristics of liquid alloys of complex composition for alloying outside the furnace in the production of high-quality alloy steels. Calculations were made of the activation energy for viscous flow of these alloys. The results are explained from the point of view of bonding forces between homogeneous and nonhomogeneous, constituent particles of the melt. (tr-auth)

1278 CRYSTAL STRUCTURE, MAGNETIC AND MAGNETO-ELASTIC PROPERTIES OF GdM_2 FILMS OF LAVES PHASE TYPE. Domyshev, V. A.; Egorov, V. A.; Buravikhin, V. A.; Sidorenko, L. M.; Luzgin, N. I. (Irkutskij Pedagogicheskij Inst. (USSR)). Fiz. Metal. Metalloved.; 38: No. 1, 102-109(Jul 1974). (In Russian).

For English translation see the journal Phys. Met. Metallogr.

Intermetallic compounds having a structure of the Laves phase type were obtained in a film state in gadolinium alloys containing transition d-metals from manganese to copper. In this case the phase formation activity increases with increasing atomic number of the d-element. This behavior corresponds to regularities in the formation of binary alloys in the massive state. The lattice parameters of the compounds in the film state are greater than in the massive state. The radius of the gadolinium atom is compressed in all the compounds, while the radii of the d-elements are expanded. Analysis of the dependence of R_m/R_T shows that in the film state the value of this ratio is closer to the theoretical value (1.225). Crystals of film compounds have a plastic form. A correlation was established for the first time between a change in substructure, and the magnetic and magnetic-elastic properties of the compounds. The coercive force changes with an increase in the magnitude of the region of coherent scattering. Anisotropic internal stresses are the main contributors to the occurrence of magnetic anisotropy. (tr-auth)

1279 HIGH-TEMPERATURE THERMOMECHANICAL TREATMENT OF DEFORMABLE MAGNESIUM-LITHIUM ALLOY IMV2. Drits, E. M.; Trokhova, V. F.; Elkin, F. M.; Malinkina, T. I. Izv. Akad. Nauk SSSR, Metal.; No. 5, 213-216(Sep 1974). (In Russian).

For English translation see the journal Russ. Metall.

A study was made of the effect of a high-temperature thermomechanical treatment (HTMT) on the change in mechanical properties and structure of magnesium-lithium alloy IMV2 having an alpha plus beta structure. The chemical composition of poured samples was close to the following calculated value: Mg + 8% Li + 5% Al + 4% Cd + 1% Zn + 0.5% Mn. The HTMT consisted in heating the samples up to 325 to 400°C for a period of 1 hour, holding in air at 100, 125, 150, 175, 200, 225, and 250°C, and pressing at these temperatures into a rod having a diameter of 10.5 mm. As a result of using HTMT the strength characteristics of the alloy were improved. A study was made of the dependence of the mechanical properties of the IMV2 alloy as a function of the deformation temperature. The change in structure of the IMV2 alloy is shown on using hot pressing and HTMT. The use of HTMT for complex magnesium-lithium alloys is advantageous, since a stable increase in strength properties (by 20 to 25%) can be directly attained by subjecting the alloy to pressure. (tr-INIS)

1280 STRUCTURE OF PLASTICALLY DEFORMED IRON-COBALT-VANADIUM ALLOY. Dubovoj, A. G.; Zalutskij, V. P.; Nesterenko, E. G.; Chumachenko, V. K. (AN Ukrainskoj SSR, Kiev. Inst. Metallofiziki). Fiz. Metal. Metalloved.; 38: No. 1, 126-131(Jul 1974). (In Russian).

For English translation see the journal Phys. Met. Metallogr.

Neutronographic and x-ray studies were made of the structures of ordered and disordered Fe-Co-V alloys. It was established that on deforming the ordered alloys by compression a decrease in the size of the antiphase domains takes place, and the degree of order is decreased. It is shown that the distortion of the crystal structure of the ordered alloys after plastic deformation is higher than that of the disordered alloys. It is suggested that the decrease in the degree of order on deformation of the ordered alloys is associated with the occurrence of a disordered layer along the boundaries of the antiphase domains. (tr-auth)

1281 HEAT TREATMENT EFFECT ON THE MAGNETIC PROPERTIES OF RARE EARTH BASE ALLOYS WITH COBALT AND COPPER. Livshits, B. G.; Samarin, B. A.; Tsertsadze, Dzh. V. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 5, 136-137(1974). (In Russian).

For English translation of selected articles see the journal Stal USSR.

A study was made of the effect of homogenization and annealing temperature on the magnetic properties of the alloy $Sm_{0.75}Ce_{0.25}Co_{3.3}Cu_{1.2}Fe_{0.5}$, which was melted in an electrode arc furnace in an atmosphere of helium. The magnetic properties were measured by a ballistic method on metal powders oriented in a magnetic field. Homogenization substantially smooths out the effect of annealing temperature on magnetic properties, and increases the general level of magnetic properties. The best magnetic properties (B_g – 6800 Gs; H_c – 5200 Oe; H_m – 6600 Oe; $(BH)_{max}$ – 10.8×10^6 Gs.Oe) were obtained after sample homogenization with subsequent annealing at a temperature of 400°C. (tr-SJR)

1282 TO THE PROBLEM ON RELAXATION PHENOMENA IN METALS AND ALLOYS. Mal'tseva, G. K.; Piterimov, V. A. Izv. Akad. Nauk SSSR, Metal.; No. 5, 189-196(Sep 1974). (In Russian).

For English translation see the journal Russ. Metall.

In considering the temperature dependence of the relaxation of the electrical conductivity of thirty metals, maxima were found in the region of 0.55 of the melting temperature according to the absolute scale of temperatures. From the absence of a maximum in filament crystals of copper and from the fact that in all the metals under study the maxima lie in the same temperature-frequency region as the well-known grain-size-limited, internal friction peaks, it is possible to explain the appearance of maxima with an excess of grain boundaries. Because of the sensitivity of the method it is possible to observe polymorphic transformations in metals and unknown relaxation phenomena in alloys. (tr-SJR)

1283 IMPACT STRENGTH ANISOTROPY OF THE DEFORMED SHEETS OF THE TsM-2A AND TsM-5 MOLYBDENUM ALLOYS. Malkhasyan, N. M.; Gulyaev, A. P.; Morgunova, N. N. Probl. Prochnosti; No. 6, 67-71(Jun 1974). (In Russian).

For English translation see the journal Strength. Mater.

Results are presented of a study of the impact strength of sheets of TsM-2A molybdenum alloy obtained by rolling in one direction with rotation of the piece by 90° after each pass and of sheets of TsM-5 molybdenum alloy rolled in one direction as a function of the direction of sample cut with respect to the direction of rolling, orientation of the cut to the plane of deformation and sharpness of the cut under various temperature conditions. (tr-auth)

1284 ALUMINIUM AND OXYGEN EFFECT ON METASTABLE PHASE FORMATION IN TITANIUM ALLOYS WITH β-STABILIZING ELEMENTS. Fedotov, S. G.; Konstantinov, K. M.; Sinodova, E. P.; Maksimov, Yu. A. Izv. Akad. Nauk SSSR, Metal.; No. 4, 169-174(Jul 1974). (In Russian).

For English translation see the journal Russ. Metall.

The effect of aluminum on the structure and properties of Ti-V alloys as a function of thermal treatment and the effect of oxygen on the properties of equilibrium and quenched Ti-Mo alloys were studied. Metastable states of the alloys were obtained by quenching them from the region of the existence of a homogeneous, beta-solid-solution. The main method of study was to follow the concentration dependence of the elastic properties, which are sensitive to a change in phase structure and in state of an alloy after varying the thermal treatment. Dependencies are presented for the Young's modulus of annealed and quenched Ti-Al-V alloys containing 1, 3, 5, and 8 wt % Al as a function of the vanadium content, and also of the Young's modulus of annealed and quenched Ti-Mo-O alloys as a function of the molybdenum and oxygen contents. On introducing 3 wt % Al or more into a Ti-V alloy the formation of stage intermediate between the alpha- and beta-solid solutions (of an omega phase which improves the elastic properties of quenched alloys) was not observed over the whole interval of concentrations investigated. The alpha-stabilizing, replacement elements (Al, Sn) in contrast to oxygen have a definite effect on the main stages of the martensitic transformation in titanium alloys containing beta-stabilizers: they impede the redistribution of elements in the beta-phase, and lead to an unstable, intermediate stage of the displacement process (of the omega-phase). (tr-auth)

1285 ELASTIC DEFORMATIONS DURING ANISOMORPHOUS DECOMPOSITION OF SUPERSATURATED SOLID SOLUTIONS. Kokorin, V. V.; Chuistov, K. V. (AN Ukrainskoj SSR, Kiev. Inst. Metallofiziki). Fiz. Metal. Metalloved.; 38: No. 1, 83-89(Jul 1974). (In Russian).

For English translation see the journal Phys. Met. Metallogr.

An analysis was made of the effect of the form of regions enriched in impurity atoms, which occur during the nonisomorphous breakdown of supersaturated solid solutions, on the intensity distribution of diffuse x-ray scattering. A calculation was made of the form of diffuse scattering regions in the case where there are coherent matrices with a cubic lattice, and equiaxial regions with a tetragonal lattice. The theoretical results are compared with experimental results of an x-ray study of the initial stages in the aging of a Cu-Be alloy. (tr-auth)

1286 CARBON DIFFUSION IN FERRITE OF ALLOYED STEELS. Kupalova, I. K.; Zemskij, S. V. Izv. Akad. Nauk SSSR, Metal.; No. 4, 23-25(Jul 1974). (In Russian).

For English translation see the journal Russ. Metall.

This study investigates the effect of an alloying additive of cobalt along with an additive of tungsten, molybdenum or chromium on the diffusion mobility of carbon in an alloy-steel ferrite. Three pairs of steel containing the same amount of carbon (0.8%) are considered: Y8X4, Y8XK10; Y8M5, Y8M5K10; Y8B6, Y8B6KM0. In each pair one steel contained 10% cobalt, and the other contained no cobalt. The first pair contained chromium (3.7 to 3.9% Cr); the second pair contained molybdenum (5.2 to 5.3% Mo), and the third pair contained tungsten (5.5 to 5.7% W). In the samples selected for investigation there were carbides present. Cobalt lowers the diffusion mobility of all the steels under study (the most for steel Y8X4 and the least for steel Y8B6). For all the steels the effect of the cobalt addition was greatest in the region of the diffusion anneal temperature. A presentation is given of the temperature dependencies of carbon diffusion coefficients in the ferrite of the steels under study, calculated with the carbide phase being taken into account and without the carbide phase being taken into account. (tr-INIS)

1287 INFLUENCE OF SUBSTRUCTURE ON THE CHANGES IN THE PROPERTIES OF STEELS UNDERGOING SECONDARY HARDENING DURING TEMPERING. Marshalkin, A. N.; Kulakov, Yu. A. (Moskovskij Vechernij Metallurgicheskij Inst. (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 9, 121-124(1974). (In Russian).

For English translation see the journal Stal USSR.

A study is made of the effect of substructure of dispersed-strengthened steel 40 on its mechanical properties. The precipitation of dispersed carbide particles in average-carbon steels alloyed with vanadium is manifested in an additional, phase, cold hardening, in the strengthening of dislocation subboundaries and in the formation of a stable, subgranular structure even on heating to very high temperatures (up to 800°C). The creation of this stable substructure has a substantial effect on improving the mechanical properties. (tr-auth)

1288 MAGNETIC PHASE DIAGRAMS AND DOMAIN STRUCTURE OF FERROMAGNETIC CRYSTALS WITH SYMMETRY AXIS OF HIGH ORDER. Mitsek, A. I.; Kolmakova, N. P.; Sirota, D. I. (AN Ukrainskoj SSR, Kiev. Inst. Metallofiziki). Fiz. Metal. Metalloved.; 38: No. 1, 5-47(Jul 1974). (In Russian).

For English translation see the journal Phys. Met. Metallorg.

Magnetic phase diagrams of magneto-single-axial ferromagnetic compounds were studied; a look was taken at particular points corresponding to phase transitions of the first and second kind, and the domain structure existing in regions of metastability of phase transition of the first kind is taken into account. Magnetization curves are presented for Gd at values of the anisotropy constants corresponding to temperatures of 4.2, 77, and 90°K, and for Co and MnBi at values of the anisotropy constants taken for 293°K. It is noted that on interpreting the magnetization curves of Gd and its alloys, it is undesirable to control the magnetic phase composition over the entire span of magnetic fields because of the complexity of the domain structure of the latter. (tr-auth)

1289 PHYSICAL AND MECHANICAL PROPERTIES PERFORMANCE AND TECHNOLOGICAL CHARACTERISTICS OF ELECTRODE ALLOYS. Nikolaev, A. K.; Novik, F. S.; Rozenberg, V. M.; Sliozberg, S. K. Tsvetn. Metal.; No. 11, 53-59(Nov 1974). (In Russian).

For English translation see the journal Sov. J. Non-Ferrous Met.

Recommendations are given for selecting the most effective electrode alloys in welding carbon and stainless steels. A correlation analysis on the MINSK-22 computer shows that the operating properties of these alloys are determined mainly by the rate at which disordering processes occur in the alloys over the interval of operating temperatures. A proposal is made to outline with greater precision the methods of alloying copper alloys of high heat strength. (tr-auth)

1290 KINETICS OF FINE LAMELLAR DISCONTINUOUS PRECIPITATION IN SUPERSATURATED MIXED CRYSTALS OF THE Cu-In SYSTEM. Predel, B.; Gust, W. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Metallkunde). Mater. Sci. Eng.; 17: No. 1, 41-50(Jan 1975). (In German).

Cu-In alloys with 3.5, 5.0, 7.5, 10.0 at.% In were used in the investigations reported. The transition region between continuous precipitation and discontinuous precipitation reactions is deter-

mined. The activation energy of boundary surface diffusion, obtained from different models, shows only slight concentration-dependence; it increases somewhat with increasing In content of the starting matrix. The criterion given by Fournelle and Clark was found to apply to the Cu-In systems. (INIS)

1291 MAGNETIC SUSCEPTIBILITY OF POLYCRYSTALLINE TERBIUM IN THE NEIGHBORHOOD OF THE NEEL TEMPERATURE. Arajs, S.; Kelly, J. R.; Rao, K. V.; Rapp, O. (Clarkson College of Tech., Pottsdam, NY). J. Low Temp. Phys.; 21: No. 1/2, 91-96 (Oct 1975).

It was found that below T/sub N/, the susceptibility diverges logarithmically in parallel T/sub N/–T parallel in good agreement with previous studies by Boyarskii and Starikov. Above T/sub N/, no logarithmic divergence is observed. (auth)

1292 DEFORMATION ATTENUATION OF ULTRASONIC SHEAR WAVES IN ALUMINUM. Berre, B. (Agricultural Univ. of Norway, Aas-NLH); Gabestad, H. K. J. Low Temp. Phys.; 21: No. 1/2, 97-108 (Oct 1975).

The deformation contribution to the electronic attenuation of ultrasonic shear waves in aluminum is measured to be of the same order of magnitude as for longitudinal waves. This real metal effect is found highly anisotropic, depending both on the direction q/q and the polarization epsilon of the ultrasound. An anisotropic deformation parameter K/sub y/ is therefore suggested as being large whenever epsilon is close to the edge WK of the Fermi surface. (auth)

1293 DEMAGNETIZATION OF Ce IMPURITIES IN SUPERCONDUCTING (La,Th)Ce ALLOYS: SPECIFIC HEAT RESULTS. Luengo, C. A.; Huber, J. G.; Maple, M. B. (Univ. of California, San Diego). J. Low Temp. Phys.; 21: No. 1/2, 129-151 (Oct 1975).

Detailed measurements of the specific heat jump DELTA C at the superconducting transition temperature T/sub c/ as a function of T/sub c/ are reported for several (La,Th)Ce systems. The measurements document the continuous demagnetization of the Ce impurity ions which proceeds with increasing Th concentration, and provide a critical test of a theory recently developed by Mueller–Hartmann and Zittartz for the superconducting behavior of matrix–impurity systems which simultaneously exhibit both superconductivity and the Kondo effect. (auth)

1294 EFFECTS OF THE SUBSTRATE TEMPERATURE ON SPUTTER-DEPOSITED NIOBIUM FILMS. Saito, Y. (Yamanashi Univ., Kofu, Japan); Anayama, T. J. Low Temp. Phys.; 21: No. 1/2, 169-177 (Oct 1975).

The superconducting transition temperatures and the structural properties of Nb films prepared by sputtering were studied over a deposition temperature range of -130 to 700°C. Niobium films show a preferred orientation in the [110] direction perpendicular to the substrate surface. The transition temperatures of Nb films deposited onto cryogenic substrates were greatly reduced. A close correspondence between the d spacing d_{110} and superconducting T/sub c/ has been found. The T/sub c/ of Nb films decreases rapidly with increasing spacing d_{110}. (auth)

1295 MAGNETIC SUSCEPTIBILITY OF POLYCRYSTALLINE SAMARIUM BETWEEN 4 AND 300 K. Arajs, S. (Clarkson College of Tech., Pottsdam, NY); Rao, K. V.; Hedman, L.; Astroem, H. U. J. Low Temp. Phys.; 21: No. 1/2, 197-201 (Oct 1975).

The chi vs T curve exhibits two peaks, a large one at 15°K and a small one at 106°K. The magnetic susceptibility between the Neel temperature T/sub N/ equals 106°K and 300°K obeys the predictions of the Stewart theory. Hysteretic effects in the magnetic susceptibility around T/sub N/ were also demonstrated, indicating that no significant results on critical indices could be obtained from these measurements. (auth)

1296 DIRECT OBSERVATION OF CURRENT-INDUCED FLUX FLOW IN A TYPE-II SUPERCONDUCTOR BY NEUTRON DIFFRACTION. Schelten, J.; Ullmaier, H.; Lippmann, G. (Institut für Festkörperforschung der Kernforschungsanlage, Jülich, BRD, Germany). Phys. Rev. B 12: No. 5, 1772-1777 (1 Sept 1975).

Lattice planes that are in reflection position at rest must be rotated in order to keep them reflecting when the lattice is moving. This principle was applied to observe the motion of flux lines caused by a transport current in an almost ideal type-II NbTa superconductor. The periodic arrangement of flux lines was found to persist up to transport currents 20 times larger than the critical current, corresponding to a mean flux velocity of 1 $msec^{-1}$. The velocities determined by neutron diffraction are in agreement with the value E/B, where E is the macroscopic electric field across a current-carrying superconductor and B is the flux density. (auth)

1297 THERMODYNAMIC PROPERTIES OF SUPERCONDUCTORS CONTAINING IMPURITIES IN A CRYSTAL-FIELD SINGLET GROUND STATE. Heiniger, F. (Bell Laboratories, Murray Hill, New Jersey 07974); Bucher, E.; Maita, J.P.; Longinotti, L.D. Phys. Rev. B 12: No. 5, 1778-1789 (1 Sept 1975).

Experimental results on superconducting and magnetic properties of La_3In and La_3Tl containing magnetic impurities are presented and discussed. From magnetic susceptibility and low-temperature specific heat we conclude that Pr^{3+} substituted for La^{3+} in these compounds is in a crystal-field singlet ground state; this also explains the characteristic behavior of the superconducting transition temperature as a function of the Pr concentration. The upper critical field of $(La_{1-x}Pr_x)_3In$ is limited by the mean exchange field due to the Pr ions which are polarized in the external magnetic field. At Pr concentrations higher than $x=0.90$ the system $(La_{1-x}Pr_x)_3In$ shows a transition to a self-polarized antiferromagnetic state at low temperatures. (auth)

1298 EFFECT OF MOLYBDENUM AND VANADIUM ON THE LATTICE THERMAL CONDUCTIVITY AND LORENZ NUMBER OF CHROMIUM. Mitchell, M.A.; Goff, J.F. (White Oak Laboratory, White Oak, Silver Spring, Maryland 20910). Phys. Rev. B 12: No. 5, 1858-1867 (1 Sept 1975).

The thermal conductivity and electrical resistivity of three Cr alloys with 3.89- and 9.35-at.% Mo and 4.57-at.% V have been measured in the temperature range from 3 to 300 K. The lattice thermal conductivity derived from these measurements is found to have maximum between 40 and 60 K and a magnitude at these temperatures that is much less than theoretical estimates. Point defects cannot explain these low magnitudes. Since the magnitude of the lattice thermal conductivity tends to increase as the Néel temperature of the alloy series decreases, there may possibly be phonon-magnon scattering present. All alloys show anomalously large values of the Lorenz number at temperatures above 100 K of the sort that has been seen in pure Cr. The lattice thermal conductivity is too small to explain this anomaly, and it must be an electronic effect as has been proposed. (auth)

1299 EXCITATION-ENERGY-DEPENDENT RESONANCES IN X—RAY EMISSIONS UNDER NEAR-THRESHOLD ELECTRON EXCITATION OF THE Ce 3*d* AND 4*d* LEVELS. Chamberlain, M.B.; Baun, W.L. (Air Force Materials Laboratory (MBM), Wright–Patterson AFB, Ohio 45433). J. Vac. Sci. Technol. 12: No. 5, 1047-1051 (Sept 1975).

Soft x-ray appearance potential spectra of the 3*d* and 4*d* levels of polycrystalline cerium metal are reported in this paper. Resonant x-ray emissions are observed when the electron-excitation energy sweeps through the ionization energies of the 3*d* and 4*d* levels. The resonant x rays excited at the 3*d*-level onsets are considerably more intense, and are excited at a lower electron-excitation energy than the 3*d*-series characteristic x rays. In the neighborhood of the 4*d*-electron thresholds, four line-like structures extend to ~8 eV below the 4*d*-electron binding energies, while two broad and more intense structures occur above the 4*d* onsets, with the largest one reaching a peak intensity at 12 eV above the 4*d* thresholds. The resonant emissions apparently arise from the decay of threshold-excited states which are bound to the inner vacancy and have core configurations nd^94f^n, (n=3,4). The exchange interaction between the three 4*f* electrons and the respective *d*-orbital vacancy spreads the 4*d*-threshold structures over a 20 eV range of excitation energies and the 3*d*-threshold structures over a much smaller range. (auth)

1300 ANOMALOUS INELASTIC NEUTRON SCATTERING IN bcc Zr-Nb ALLOYS. Axe, J.D.; Keating, D.T. (Brookhaven National Laboratory, Upton, New York 11973); Moss, S.C. Phys. Rev. Lett. 35: No. 8, 530-533 (25 Aug 1975).

Inelastic neutron scattering from bcc $Zr_{0.92}Nb_{0.08}$ at 965°C reveals features in the inelastic response which lack the average cubic symmetry of the lattice. This can be understood as arising from phonon modulation of quasistatic short-range order representing fluctuations into an incipient "ω" phase. (auth)

1301 MAGNETOACOUSTIC GEOMETRIC OSCILLATIONS FOR LONGITUDINAL SOUND IN BERYLLIUM. Vozenilek, E.F.; Reed, R.W. (Department of Physics, The Pennsylvania State University, University Park, Pennsylvania 16802). Phys. Rev. B 12: No. 4, 1140-1145 (15 Aug 1975).

Magnetoacoustic, geometric oscillations have been observed in the absorption of longitudinal ultrasound in single crystals of Be of high purity. The investigation was carried out at 1 K using sonic frequencies from 0.5 to 1.85 GHz. Caliper dimensions of the cigar and coronet pieces of the Fermi surface in Be were determined. These dimensions are consistent with the current theoretical models for the Fermi surface in Be. (auth)

1302 OPTICAL PROPERTIES OF CRYSTALLINE TUNGSTEN. Weaver, J.H. (Physical Sciences Laboratory, University of Wisconsin, Stoughton, Wisconsin 53589); Olson, C.G.; Lynch, D.W. Phys. Rev. B 12: No. 4, 1293-1297 (15 Aug 1975).

The optical properties of W are presented between 0.15 and 33 eV. The optical absorptivity or reflectivity was measured at near-normal incidence, and the data were Kramers-Kronig analyzed to determine the dielectric functions. Drude parameters were determined at low energy

and were used to separate interband and intraband contributions to ϵ_2. Structures in ϵ_2 were apparent at 0.42, 0.97, 1.82, 2.35, 3.42, 5.25, 8.8, 11.3, 16.5, 22.5, and 31.5 eV. These features were discussed in terms of recent calculations of Christensen and Feuerbacher and by analogy to other transition metals studied. The loss functions were shown to have three volume plasmons (25.3, 15.2, and 10.0 eV) and three surface plasmons (20.8, 14.8, and 9.7 eV). Structure near 31.5 eV was interpreted as due to N_{VII} core transitions. (auth)

1303 EXCHANGE INTERACTION AND RELAXATION IN $LuAl_2$:Ce AND YAl_2:Ce INTERMETALLIC COMPOUNDS. Rettori, C.; Davidov, D. (Racah Institute of Physics, The Hebrew University, Jerusalem, Israel and Physics Department, University of California, Los Angeles, California 90024); Ng, G.; Chock, E.P. Phys. Rev. B 12: No. 4, 1298-1303 (15 Aug 1975).

The spin-flip scattering of conduction electrons due to Ce ions was measured by breaking the ESR bottleneck present in $LuAl_2$:Gd and YAl_2:Gd with the addition of Ce. The exchange interaction between the Ce ions and the conduction electrons was extracted using the model of Cornut and Coqblin. (auth)

1304 CALCULATION OF THE PHONON SPECTRUM IN THORIUM. Rosengren, A. (Institute of Theoretical Physics, University of Stockholm, Stockholm, Sweden); Ebbsjö, I.; Johansson, B. Phys. Rev. B 12: No. 4, 1337-1342 (15 Aug 1975).

Due to the comparatively extended *d* states in the transition metal thorium, it is argued that the pseudopotential method may be a fairly realistic approach to this element. Calculations of the phonon spectrum with an empirically derived form factor are shown to give quite good agreement with recent experiments. Also the calculated values of the elastic constants, the bulk modulus, the Debye temperature, and the binding energy are found to be most reasonable. (auth)

1305 ANOMALOUS WEAK-FIELD MAGNETIC HYSTERESIS IN PLASTICALLY DEFORMED AND ANNEALED GADOLINIUM NEAR THE CURIE TEMPERATURE. Milstein, F.; Baldwin, J.A. Jr.; Rizzuto, M. (College of Engineering and Quantum Institute, University of California, Santa Barbara, California 93106). J. Appl. Phys. 46: No. 9, 4002-4005 (Sept 1975).

The Rayleigh parameters of cold-worked and annealed polycrystalline gadolinium have been measured at 10 °C. In contrast with the usual findings, they are relatively insensitive to the state of lattice disorder. The small-signal hysteresis loop differs qualitatively from the usual Rayleigh loop in that remanence is proportional to the first power, rather than the square, of the field amplitude. (auth)

1306 ELECTRICAL RESISTIVITIES OF NORMAL-SUPERCONDUCTING TWO-PHASE MIXTURES. Callaghan, T.J.; Toth, L.E. (Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, Minnesota 55455). J. Appl. Phys. 46: No. 9, 4013-4017 (Sept 1975).

Electrical resistivities of multiphased wires in which one phase is a continuous normal conductor and the other is a discontinuous superconducting phase have been studied as a function of mechanical reduction (Re) and current density *J*. Even for *J* values of 10^3 A/cm^2 the electrical resistivity decreases somewhat faster than $1/Re^3$, a dependence that can be predicted from a number of metallurgical microstructure models. For *J* values of 10 A/cm^2 or less, most of the current is carried by superconducting or superconductinglike paths. Metallurgical studies rule out the possibility of continuous Nb paths and, therefore, the proximity effect is the most likely cause for the reduced resistivity even though the average interparticle spacing is large. (auth)

1307 TUNNEL INVESTIGATIONS OF SUPERCONDUCTING Nb_3Al FILMS. Vedeneev, S.I. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. Phys.—Solid State 17: No. 3, 602-603 (Mar 1975).

Current-voltage curves for superconducting Nb_3Al films are presented. By studying the tunnelling properties, the energy gap is determined. Measurements of the critical temperature are also reported. (AIP)

1308 MAGNETORESISTANCE OF *n*-TYPE InSb IN THE QUANTUM LIMIT. Aliev, M.I.; Askerov, B.M.; Agaeva, R.G.; Daibov, A.Z.; Ismailov, I.A. (Institute of Physics, Academy of Sciences of the Azerbaizhan SSR, Baku). Sov. Phys.—Semicond. 9: No. 3, 377-378 (Sept 1975).

The magnetic field dependence of the longitudinal and transverse magnetoresistance of InSb was investigated. The experimental results are compared to the predictions of the two-band Kane model. (AIP)

1309 NMR AND MOESSBAUER STUDY OF ELECTRON AND PHONON SPECTRA IN THE SUPERCONDUCTING V_3X COMPOUNDS. Fradin, F. Y.; Kimball, C. W. (Argonne National Lab., Ill. (USA)). pp 355-356 of Magnetic Resonance and Related Phenomena. Vol. II. Allen, P. S. (ed.). Amsterdam; North Holland Publishing Co. (1975).

From 18th Ampere congress on magnetic resonance and related phenomena; Nottingham, Eng. (9 Sep 1974).

Results of ^{51}V NMR measurements of spin-lattice relaxation rates, nuclear-electric-quadrupole interactions, and results of ^{119}Sn Mössbauer-effect measurements of the recoil-free fraction and thermal shift in vanadium-based A-15 compounds are discussed in terms of the electron and phonon spectra. (auth)

1310 SOME OBSERVATIONS ON THE HEAT CAPACITIES OF PALLADIUM–INDIUM AND PALLADIUM–TIN INTERMEDIATE PHASES. Bryant, A. W.; Bird, J. M.; Pratt, J. N. (Univ. of Birmingham, Eng.). J. Less-Common Met.; 42: No. 2, 249-253(Sep 1975).

Differential scanning calorimetry has been used to measure the specific heat capacities of the intermetallic phases Pd_3In, Pd_2In, PdIn, Pd_2In_3, Pd_3Sn, Pd_2Sn and PdSn between 150 and 298°K. The data are discussed in relation to possible changes in electronic and vibrational heats on alloying, and are compared with values calculated using Lindemann's approximation and the two-Debye-temperature model of specific heats. (auth)

1311 ELECTRON STRUCTURE OF TETRABORIDES. Samsonov, G. V.; Goryachev, Yu. M.; Kovenskaya, B. A.; Arabei, B. G. (Inst. of Problems in Materials Science, Kiev). pp 171-174 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132–P1.

The preliminary results of the calculation of the electron structure of tetraborides by the LCAO method were reported. A comparison was made of analogous calculations for other higher borides. Correlations were made between the calculated data and experimentally observed properties of higher metal borides. (tr-auth)

1312 PROPOSAL REGARDING THE ELECTRONIC STRUCTURE OF α'-Ce. Hill, H. H.; Kmetko, E. A. (Los Alamos Scientific Lab., NM). J. Phys., F (London); 5: No. 6, 1119-1129(Jun 1975).

It is suggested that, contrary to general assumptions, there is a preponderance of f character in the valence band of α'-Ce. The approach used is that previously applied to the early actinide metals. It is shown that melting point correlations and self consistent APW band calculations yield similar f electron occupation numbers for α'-Ce and γ-Ce and similar principal bonding electron numbers for α'-Ce and α-U. The latter correspondence makes the fact that α'-Ce and α-U possess the same crystal structure more understandable. (auth)

1313 LOW-FREQUENCY AC SUSCEPTIBILITY OF A SUPERCONDUCTING Pb–Sn EUTECTIC ALLOY. Rossiter, P. L.; Schafe, L. M. (Monash Univ., Clayton, Australia). Philos. Mag.; 31: No. 6, 1271-1287(Jun 1975).

The experimentally determined ac susceptibility is not explained by the critical surface state or effective conductivity models. A simple quasistatic model, valid in both static and swept dc fields, is developed which implicitly takes into account contributions to surface hysteresis. The model is in reasonable agreement with experimental results and is in accord with the observed magnetization curve. The magnetization and ac susceptibility show that flux motion through the surface is sensitive to the sense of the applied field change. This is not explained by the available flux creep models but is in accord with surface rectification effects. In view of the pinning centers in the surface region this seems reasonable. (auth)

1314 DIFFUSION STUDIES IN THE TERNARY SYSTEM Ti–V–Zr. Brunsch, A. Stuttgart; Univ. Stuttgart (1974). 128p. (In German). INIS.

Thesis.

Diffusion behaviour in the ternary system Ti–V–Zr was studied at 800°C along with the binary boundary systems Ti–V and Ti–Zr in the temperature region of 650 to 1,050°C. The reciprocal Onsager relation for interdiffusion coefficients was derived for the first time assuming concentration-independent but different partial molar volumes and the case of an ideal solution. The diffusion in the binary boundary systems Ti–V and Ti–Zr comprises time and temperature dependence of the growth of self-forming diffusion layers, calculation of the chemical diffusion coefficients, investigation of their concentration and temperature dependence, as well as determination of the concentration dependent activation energies and frequency factors. The so-called Kirkendall effect, i.e., the migration of the original melded planes, was investigated in both systems at 800°C using W-wire markers. The four interdiffusion coefficients were calculated at 58 different concentrations and are given in tables. (GE)

1315 THERMALIZATION EFFECTS IN RF SPUTTERING OF A 15 SUPERCONDUCTORS. Chencinski, N. New York; City Univ. of New York (1975). 106p. University Microfilms Order No. 75-11,977.

Thesis (Ph. D.).

Recently the A 15 superconductor Nb_3Ge was prepared by high pressure dc sputtering with a T/sub c/ of 23.2°K. Effects of thermalization of the sputtered atoms in the preparation of Nb_3Ge and compounds found in the composition range Nb_3Al/sub 1-x/ Ge/sub x/, 0 less than or equal to x less than or equal to 1, effects on T/sub c/ of the substrate temperature, pressure, sputtering gas, and target to substrate distance were investigated. A T/sub c/ of 21.7°K was obtained for Nb_3Ge by using 20 mtorr krypton as the sputtering gas. A theoretical background discussion of the relation between the normal state parameters of transition metals to the superconducting transition temperature is presented. The applications and limitations of several different interpretations of the parameters affecting the electron phonon coupling parameter are also discussed. (Diss. Abstr. Int., B)

1316 THERMODYNAMICS OF LATTICE DISORDER OF BETA' PdIn PHASE. Anantatmula, R. P. (Washington State Univ., Pullman). Acta Metall.; 23: No. 10, 1205-1208(Oct 1975).

Atomic absorption spectroscopy was used to determine the vapor pressure of indium in equilibrium with solid beta' Pd–In alloys at 1043°K. Thermodynamic activity, relative partial molar properties, and excess properties of indium were calculated. Lattice parameters also were determined for the alloys from Debye–Scherrer patterns, which indicated the type of defect in this CsCl phase to be palladium substitutionals and palladium vacancies. The experimental activities were compared with those calculated from Libowitz's equations. Excellent agreement between theory and experiment was obtained for a defect concentration of 8.14×10^{-4}. The defect parameters of beta' PdIn are comparable to those obtained in the case of CsCl phases of other transition metal systems. (auth)

1317 INFLUENCE OF RESIDUAL ELEMENTS ON THE FRACTURE OF AN IRON–20 PERCENT COBALT–5 PERCENT MOLYBDENUM ALLOY. Musiol, C.; Brook, R. (Univ. of Sheffield, Eng.). Acta Metall.; 23: No. 10, 1247-1253(Oct 1975).

Aspects of the inter-relation between microstructure, mechanical properties, and residual element content were studied in an Fe–20 percent Co–5 percent Mo alloy. The cooling rate after austenitising was found to be important, the changes in matrix structure and fine-scale precipitation so produced having profound effects on both the fracture mode and the mechanical properties. In a similar way, differences in carbon and oxygen contents at low concentrations were found to exert a considerable influence. (auth)

1318 EFFECT OF HEAT TREATMENTS ON THE MICROSTRUCTURE OF STAINLESS STEEL WELD METAL. Cole, N. C.; Goodwin, G. M.; Slaughter, G. M. (Oak Ridge National Lab., TN). pp 789-882 of Microstructural Science. Vol. III. French, P. M.; Gray, R. J.; McCall, J. L. (eds.). New York; American Elsevier Publishing Co., Inc. (1975).

The mechanical properties and corrosion resistance of stainless steel welds are very dependent on the morphology of ferrite in the austenitic matrix. Since heat treatments can markedly influence this morphology, a study was made of the time–temperature influence on welds made by different processes. Welds made by the shielded metal-arc (SMA), submerged-arc (SA), and electroslag (ES) processes were heat treated to explore their response to (a) solution annealing [870 to 1190°C for 1 to 10 h], (b) solution annealing and carbide agglomeration [730 to 855°C for 10 to 100 h], and (c) aging [535 to 800°C for 10 to 1000 h]. Weld metals of slightly differing microstructures (amount and distribution of ferrite) responded quite differently to typical heat treatments. For example, a solution anneal at 980°C for 1 h caused substantial dissolution and agglomeration of ferrite in SMA welds (finer ferrite substructure), whereas a much longer time or higher temperature is required for the same effect on SA welds (coarser substructure). The brittle sigma phase formed rapidly from ferrite, and its morphology depended upon whether the welds had been solution annealed before aging. In addition, the formation of carbide networks differed with heat treatment, and the location of the carbides varied with the amount of ferrite. (auth)

1319 STUDY OF POINT DEFECTS IN QUENCHED TUNGSTEN BY COMBINED FIELD ION MICROSCOPY AND ELECTRICAL RESISTIVITY. Park, J. Y. Ithaca, NY; Cornell Univ. (1975). 89p. University Microfilms Order No. 75-18,142.

Thesis (Ph. D.).

Point defects in quenched tungsten were studied by combined field ion microscopy and electrical resistivity. Oriented high-purity single-crystal tungsten rods with the [112] direction parallel to the rod axis were prepared by electron beam zone-melting. Thin single-crystal wire specimens (61-122 mu m dia) were obtained from these rods by electropolishing. These specimens were then heated resistively to temperatures in the range of 2500 to 3565°K in an uhv manifold, and "radiation" quenched by switching off the heating current. Electrical resistivity increments quenched into the specimens were measured. The loss of defects to sinks during the quenching was corrected by extrapolation to an infinite quenching rate. The magnitude of the quenched-in resistivity increment for different specimens varied over a wide range. The quenched-in increment decreased as the expected specimen purity increased. Direct observations of the lattice defects in two specimens of different expected purity were also made by field ion microscopy by the method of pulsed field evaporation. The specimen of higher expected purity contained a considerably lower concentration of observable defects as anticipated. The field ion microscopy results established an upper limit to any quenched-in vacancy concentration of about 5×10^{-6} atomic fraction (T/sub q/ equals 3550°K). Arguments are given that about 2×10^{-6} atomic fraction might actually be a more realistic upper limit. No positive evidence for the existence of vacancies in any of the quenched specimens was obtained in this work. (Diss. Abstr. Int., B)

1320 LOCAL STRUCTURE AND PHASE TRANSFORMATION IN Zr AND Ti BASED BCC SOLUTIONS. Chang, A. L. J. Ithaca, NY; Cornell Univ. (1975). 112p. University Microfilms Order No. 75-17,987.

Thesis (Ph. D.).

High resolution direct lattice imaging and dark field electron microscopy were used to examine the omega phase transformation in Zr–Nb alloys. Direct lattice imaging demonstrates the existence of three subvariants within each omega variant. The kinematic intensity sum, which is evaluated based on the combination of certain atomic arrangements, was carried out to include both untransformed beta phase and the omega phase. An ordered sequence of subvariants was found to be responsible for the diffraction effects in high Nb content alloys. However, the existence of such an ordered sequence among omega subvariants could not be checked out because of the small size of the omega regions. Omega domains of different variant do not interweave. Isolated particles with diameters of 3 to 5 A also are present away from the domains. As the Nb content is increased the omega domains decrease in size while the isolated particles (3 to 5 A) are present over the entire range studied, from 8 to 30 wt percent Nb. It is suggested that fluctuations in structure occur between the beta and omega phases. The isolated particles, also changing with time, are believed to be images of single or small groups of displaced atoms. (Diss. Abstr. Int., B)

Radiation Effects

Refer also to abstracts 1101, 2211, and 2355.

1321 (AD/A-004838) INFLUENCE OF ION IMPLANTATION ON THE SURFACE PROPERTIES OF METALS AND ALLOYS. Interim Report, 1 September 1971–31 August 1974. Carter, G.; Grant, W. A. (Salford Univ. (UK)). 30 Oct 1974. 19p. NTIS $3.25.

A method for improving the depth resolution in Rutherford scattering measurements is presented. The application of the method is demonstrated by measurements of the range of heavy ions in silicon and aluminum and of the range distribution of Pb in silicon. (GRA)

1322 (BNWL-SA-5377) DEPENDENCE OF SWELLING ON VOID SURFACE REACTION RATE CONSTANTS. Simonen, E. P.; Brimhall, J. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 8p. (CONF-751006-3). Dep. NTIS $4.00.

From international conference on radiation damage in metals; Gatlinburg, Tennessee, USA (5 Oct 1975).

Void growth data from ion bombarded molybdenum, nickel, and 316 stainless steel are analyzed with respect to dislocation bias and void surface kinetics. The strength of the surface kinetic influence is calculated and the absence of point defect bias at voids is discussed. (auth)

1323 (CONF-751006-1) CRITICAL CURRENT CHANGES IN Nb_3Sn IRRADIATED WITH FAST NEUTRONS AT 6 K. Brown, B. S.; Birtcher, R. C.; Blewitt, T. H.; Wozniak, D. G. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-eng-38. 5p. Dep. NTIS $4.00.

From international conference on radiation damage in metals; Gatlinburg, Tennessee, USA (5 Oct 1975).

The critical current (J/sub c/) was measured in Nb_3Sn as a function of neutron dose at 6°K up to 1.8×10^{18} n/cm² (E greater than 0.1 MeV). An increase in J/sub c/ of up to 33 percent at H equals 32 kOe was observed after 1.2×10^{18} n/cm² in material with a high unirradiated J/sub c/ of 1.5×10^6 A/cm² at 4.2°K. Decreases were observed in J/sub c/ after higher doses and the size of the increase in J/sub c/ and dose of maximum J/sub c/ were a function of magnetic field. The dose and field dependence of the J/sub c/ changes are explained by a model in which the changes in flux pinning and J/sub c/ due to changes with dose in

critical temperature, upper critical field, and defect microstructure are considered. Observation of the change of the thermal transition to the normal state are understood by considering the radiation damage in the Cu–Sn stabilizing cladding. (auth)

1324 (DP-MS-75-55) SURFACE EFFECTS ON TRITIUM DIFFUSION IN MATERIALS IN A RADIATION ENVIRONMENT. Caskey, G. R. Jr. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 39p. (CONF-750806-4). Dep. NTIS $5.00.

From 170th American Chemical Society National meeting; Chicago, Illinois, USA (24 Aug 1975).

Tritium transport and distribution in a material are controlled by chemical potential and thermal gradients and cross-coupling to impurities and defects. Surfaces influence tritium diffusion by acting as sources and sinks for defects and impurities, and surface films restricting tritium transfer between the solid and surrounding fluids. Radiation directly affects boundary processes such as dissociation or adsorption, may erode a surface film or the surface itself, and introduces defects and impurities into the solid by radiation damage, transmutation, or ion implantation, thereby modifying tritium transport within the solid and its transfer across external interfaces. There have been no definitive investigations of these effects, but their practical significance has been demonstrated in tritium release or absorption studies with stainless steel, Zircaloy, niobium, and other materials. (auth)

1325 (IS-M-46) INFLUENCE OF OXYGEN ON DEFECT CLUSTERS, RADIATION HARDENING, AND RADIATION-ANNEAL HARDENING IN VANADIUM. Wechsler, M. S.; Bajaj, R. (Ames Lab., Iowa (USA)). 1975. 16p. (CONF-750952-1). Dep. NTIS $4.00.

From seminar on radiation-produced defects and defect clusters and their effects in metals; Ames, Iowa, USA (28 Sep 1975).

On increasing the oxygen concentration, the defect cluster density in neutron-irradiated vanadium increases, the average size decreases, and the stability against annealing increases. Higher oxygen concentrations in vanadium also have the effect of increasing the radiation hardening and radiation-anneal hardening. Based on a dispersed barrier model embracing defect clusters of all sizes, the radiation-anneal hardening is due principally to a strengthening of the defect clusters as barriers to slip dislocation motion, not to changes in the density and size distribution of the defect clusters. The observations are consistent with the nucleation of defect clusters by small oxygen or oxygen-point defect complexes upon irradiation and the trapping of oxygen at defect clusters upon post-irradiation annealing. (auth)

1326 (JINR–P14-8801) VACANCY POROSITY IN METALS BOMBARDED WITH ACCELERATED Fe IONS. Flerov, G. N.; Akap'ev, G. N.; Barashenkov, V. S.; Dubinskii, V. E.; Lebedev, S. Ya.; Rodionova, V. G.; Rudnev, S. I.; Surkov, S.Ya. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1975. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The phenomenon of swelling in the samples of Ni and stainless steel under the influence of Fe ions was studied using the internal beam of the cyclotron U-300. The density of the pore number and the pore parameters turned out to be the same as in the materials bombarded in fast neutron reactors at a correspondingly equal number of shifts per atom. The radiation resistances of some widespread structural materials are compared. (auth)

1327 (LA-UR-75-1849) EFFECTS OF REACTOR NEUTRON, 14-MeV NEUTRON AND ENERGETIC-CHARGED-PARTICLE IRRADIATIONS ON THE CRITICAL CURRENT IN Nb_3Sn. Parkin, D. M.; Snead, C. L. Jr. (Los Alamos Scientific Lab., N. Mex. (USA); Brookhaven National Lab., Upton, N. Y. (USA)). 1975. Contract W-7405-ENG-36. 11p. (CONF-751026-2). Dep. NTIS $4.00.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (1 Oct 1975).

Multifilamentary Nb_3Sn wires were irradiated at ambient temperature with HFBR neutrons, 14-MeV neutrons, and 17-MeV protons. The fluence dependence of the critical current density (J/sub c) at 40 kG was compared in these cases by calculating the corresponding damage energy/atom (dea). Results show that the rapid reduction in the critical current in Nb_3Sn occurs at 0.2 +- 0.05 eV/atom for the HFBR and 17-MeV-proton irradiations, whereas no significant reduction in critical current was observed after 0.29 eV/atom with 14-MeV neutrons. Extension of this analysis to published data on the effects of neutron and charged-particle irradiations both at ambient and low temperature on critical temperature (T/sub c/) and J/sub c/ shows that the maximum value of J/sub c/ ' occurs at 0.15 +- .5 eV/atom and that reductions in T/sub c/ are a function of eV/atom. A model based on site exchange disorder which accounts for these results is discussed. (auth)

1328 (ORNL-tr-4022) IMPORTANCE OF THE IRRADIATION BEHAVIOR FOR THE SELECTION AND DEVELOPMENT OF HIGH-TEMPERATURE ALLOYS FOR THE CONSTRUCTION OF REACTORS. Boehm, H. Translated by E. G. Silver from Arch. Eisenhuettenwes.; 45: 821-830(1974). 32p. Dep. NTIS $4.75.

Demands on high-temperature alloys for nuclear reactor construction are examined along with irradiation conditions in nuclear reactors of different types. Damage to metallic materials due to neutron irradiation including irradiation-induced creep, irradiation hardening and void formation is discussed along with high-temperature embrittlement and effects of irradiation on precipitation. Relations between the changes of characteristics and the chemical composition and also the structure in the initial state of the materials are considered. Plans for the further development are outlined. (auth)

1329 (ORO-3612-12) INVESTIGATION OF IRRADIATION STRENGTHENING OF b.c.c. METALS AND THEIR ALLOYS. Progress report, January 1975–October 1975. (Maryland Univ., College Park (USA). Engineering Materials Group). 1975. Contract AT(40-1)-3612. 174p. Dep. NTIS $11.75.

Results of studies on radiation strengthening of V, Mo, and Nb are presented. Information is included on deformation characteristics of low-temperature neutron-irradiated Nb, the effects of He^{3+} on the low-temperature deformation characteristics of Nb, electron-transmission microscopic studies of the nature of neutron damage effects of post-irradiation annealing, microplasticity, thermally activated dislocation motion, production of high-purity Nb and V, early stages of flow in Mo, microplasticity in V, and effects of impurity interstitials on the lattice resistance to dislocation motion. (JRD)

1330 (SSD-75-88) ELECTRICAL RESISTIVITY MEASUREMENTS ON LOW-TEMPERATURE NEUTRON-IRRADIATED FCC AND BCC METALS. Coltman, R. R. Jr. (Oak Ridge National Lab., Tenn. (USA)). 1975. 11p. (CONF-750952-2). Dep. NTIS $4.00.

From seminar on radiation-produced defects and defect clusters and their effects in metals; Ames, Iowa, USA (28 Sep 1975).

Experimental observations are presented on the production and recovery of defects in Pt and V irradiated by thermal and fission neutrons. The Stage-II temperature dependence of free defect production was studied in Pt. Fission neutrons produce correlated pairs which may thermally dissociate in the same manner as thermal neutron-damage, but the free interstitial partners do not reach traps. The beginning of the recovery in V is continuous, extending over a wide temperature range; a peak commences at 47^0K. (DLC)

1331 ELECTRON MICROSCOPE OBSERVATIONS OF VOIDS IN IRRADIATED ALUMINIUM ALLOYS. Mayer, R. M.; Morris, E. T. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Physical Metallurgy Div.). Proc. Electron Microsc. Soc. South. Afr.; 4: 93-94(1974).

Observations of voids in high purity aluminium at higher doses and in dilute Al-Si and Al-In alloys are recorded. The alloys were prepared from zone refined aluminium, the major impurity being three ppM silicon. Neutron irradiations were carried out in a hollow fuel element position in the SAFARI-1 reactor at pile temperature. Electron microscopic examination of the pure aluminium after irradiation revealed: the presence of defect clusters whose appearance was insensitive to the conditions of contrast; there were fewer voids in the Al-Si alloys and more voids in the Al-In alloys than in the pure metal; and the kinetics of void nucleation to be entirely controlled by the solute concentration. (INIS)

1332 DISLOCATION DAMPING AND DEFECT DRAGGING IN ALUMINUM: THE SLOW MODULUS EFFECT. Seiffert, S.L. (C.E.A.-C.E.N. Grenoble, 38041 Grenoble, France); Sosin, A. J. Appl. Phys. 46: No. 9, 3760-3765 (Sept 1975).

Dislocation damping and Young's modulus changes were measured on aluminum irradiated at low temperature by 1-MeV electrons. These measurements, taken at fixed temperatures, demonstrate good agreement with the prediction of the defect dragging model proposed by Simpson and Sosin and provide quantitative support of the model. Good agreement with the theoretical results is also obtained following interrupted electron-beam bombardments which take into account the temperature-dependent background damping. The very slow change in modulus reported earlier was studied further and it is shown that this slow change can be fully understood simply within the framework of the defect dragging model. (auth)

1333 ION IMPLANTATION DURING FILM GROWTH AND ITS EFFECT ON THE SUPERCONDUCTING PROPERTIES OF NIOBIUM. Heim, G.; Kay, E. (IBM Research Laboratory, San Jose, California 95193). J. Appl. Phys. 46: No. 9, 4006-4012 (Sept 1975).

Low-energy (≤ 500 eV) Kr^+ ion bombardment during film growth and its consequences on superconducting properties of Nb are studied in a triode glow discharge sputtering configuration. T_c is depressed from the bulk value at a rate of −0.19 °C/at.% dissolved in the lattice. The residual resistivity shows an increase of 3.4 μΩ cm/at.% Kr. It is shown that radiation damage due to ion bombardment dominates the superconducting properties up to 0.2 at.% dissolved, whereas above this Kr concentration, up to ~2 at.% Kr, the noble-gas content dominates the transport properties. All films show a dilated lattice which is mainly caused by energetic bombardment during film growth rather than subsequent trapping of the Kr gas. (auth)

1334 EFFECT OF ELECTRON IRRADIATION ON DOMAIN WALL PINNING DEFECTS IN 50-50 NiFe. Baldwin, J.A. Jr.; Milstein, F.; Smith, P.W. Jr. (College of Engineering, University of California, Santa Barbara, California 93106). J. Appl. Phys. 46: No. 9, 4026-4030 (Sept 1975).

A magnetic measuring technique which sorts out defects according to a distribution function n was used to study the influence of electron irradiation on 50-50 NiFe. The distribution function is determined in terms of the maximum force f_m that a defect can exert on a forward moving domain wall, or equivalently, the *range* z_0, which is the distance the mean position of the wall may move past the defect before the wall snaps free from the pinning action of the defect. The range and maximum force are related by a spring constant k, viz., $f_m = kz_0$. The quantity $n(z_0)\,dz_0$ gives the number of defects per unit volume having a range between z_0 and $z_0 + dz_0$. Distribution functions were determined before and after electron irradiation. The irradiation was for 100 min with 18-MeV electrons with a dose of 1.1×10^{17} e/cm². Following irradiation, there was a substantial decrease in the number of short-range defects (i.e., defects capable of pinning a domain wall only over a relatively short range); there was an increase in the number of long-range defects; and the total number of defects N_0 with which a steadily moving wall interacts at a given instant was found to decrease. Although the coercive force decreased, the Barkhausen noise power increased following irradiation. It has been shown by Baldwin and Milstein that the contribution to Barkhausen noise power from defects of a given range z_0 is proportional z_0^3; hence the increase in Barkhausen noise is understood in terms of the increase in long-range defects. The experimental results can be understood in terms of the effects of long-range crystallographic ordering which occurs in NiFe alloys which are subjected to electron irradiation. (auth)

1335 LOW-TEMPERATURE ENERGY RELEASE IN PLATINUM AFTER ION RADIATION. Jackson, J.J. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. B 12: No. 4, 1217-1226 (15 Aug 1975).

The release of stored energy and the change of resistivity were measured simultaneously in the same specimen during the annealing from 15 to 35 K of platinum irradiated with 20-MeV deuterons. The calorimeter and differential power analysis used are described in detail. The work was undertaken to determine whether the enhanced initial rate of resistivity increase during the irrradiation of quenched platinum, as compared to the rate in annealed platinum, results from greater Frenkel-pair production or a larger Frenkel resistivity in the quenched material. The results indicate that most of the enhancement in these irradiations represents increased production. The resistivity increment per defect added by the irradiation when measured at 5 K is increased only a few percent by the vacancies from the quench. The additional interstitials are preferentially deposited near these vacancies. Using an estimated energy stored in each Frenkel pair of 6 eV the resistivity increment at 5 K of unit concentration of Frenkel defects in platinum is 12×10^{-4} Ω cm. (auth)

1336 LUMINESCENCE OF THE (100) SURFACE OF TUNGSTEN IRRADIATED BY SLOW ELECTRONS. Artamonov, O.M. (A. A. Zhdanov Leningrad State University). Sov. Phys.—Tech. Phys. 20: No. 1, 113-114 (July 1975).

Luminescence in the visible range is detected when the (100) surface of W is irradiated by slow electrons in vacuum 10^{-10}—10^{-11} torr. The degree of polarization and the spectral distribution of the radiation are measured, as well as the energy dependence of the electrons, for a purified surface and for adsorption of residual gases and N_2. (auth)

1337 COMPARISON OF RADIATION DAMAGE IN Si AND Ge IRRADIATED WITH 660 MeV PROTONS AND FAST REACTOR NEUTRONS. Novikov, S.R.; Rubinova, E.E. (B. P. Konstantinov Leningrad Institute of Nuclear Physics, Academy of Sciences of the USSR, Gatchina). Sov. Phys.—Semicond. 9: No. 3, 352-353 (Sept 1975).

Disordered regions as well as isolated defects are studied in silicon and germanium which have been irradiated with 660 MeV protons and fast neutrons. Data is presented on the characteristics of recoil atoms and displacement cascades. (AIP)

1338 EFFECTS OF RADIATION ON MATERIALS. Vook, F.L. (Sandia Laboratories, Albuquerque). Phys. Today 28: No. 9, 34-41 (Sept 1975).

The damage caused by fast neutrons to the materials used in the construction of various types of nuclear reactors is discussed. Special emphasis is given to light-water reactors and breeder reactors. (AIP)

1339 MOESSBAUER SPECTROSCOPY WITH ^{119}Sn ON LATTICE DEFECTS AFTER REACTOR IRRADIATION AT 4.6°K. Vogl, W. Munich; Technische Univ. (1974). 96p. (In German). INIS.

Thesis.

A measuring method was developed which, by means of a combined measuring and transfer cryostat at 4.6°K, allows the use of irradiated samples as source and as absorber in a Moessbauer transmission experiment. The low-energetic recoil of 50 eV due to the (n,γ) reaction of ^{118}Sn, the effect of the high-energetic primary recoil atoms produced by fast neutrons, and the intensive local ionization through Auger electrons were investigated. The irradiations at 4.6°K were carried out to a maximum dose of 7×10^{18}n/cm². The Moessbauer spectra obtained are compared with the absorber spectrum prior to irradiation and with the spectra after annealing of the sample. Conclusions were drawn from this comparison about the processes connected with irradiation and the defects produced. The measurements were carried out with the Moessbauer transition especially suited to this method: ^{119}Sn to β-Sn (metal), α-Sn (semiconductor with diamond structure), SnO_2(IV-valent tin compound with rutile structure) and $SnSO_4$ (II-valent tin compound with IT after effect). (GE)

Other Materials

Refer also to abstracts 88, 104, 796–798, 1137, 1174, 1230, 1244, 1254, 1271, 1337, 1338, and 2211.

1340 (AD/A-003742) FRACTURE ANALYSIS OF FATIGUE DAMAGE MECHANISMS IN FIBER REINFORCED COMPOSITE MATERIALS USING SCANNING ELECTRON MICROSCOPY. Williams, R. S.; Reifsnider, K. L. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). 1974. 38p. NTIS $3.75.

A variety of experimental and analytical methods have been used in attempting to characterize the fatigue damage processes in fiber reinforced composite materials. There has, however, been a distinct lack of SEM fractography applied to this area. In this report, composite SEM fractographs (approx. 70–80x) of two composite material systems (boron/epoxy and boron/aluminum) having the same fibers, layup and geometry, but drastically different matrix materials, are presented and discussed in detail. Both high and low frequency strain controlled fatigue tests and static test fractures are examined. Distinct differences between static and fatigue damage, and high and low frequency fatigue damage were observed. These various damage modes are detailed and summarized in several tables. A physical model describing the fracture process in these materials is presented by means of a flow chart. This model considers the cases of: static or fatigue loading, high or low cycling frequency, and weak or strong interface behavior. (GRA)

1341 AD/A-004356) ELECTRICAL CONDUCTIVITY OF ALLOYED AND GAMMA-IRRADIATED NaCl BEHIND FRONT OF SHOCK WAVES. Tyunyaev, Yu. N.; Lisitsyn, Yu. V. 18 Dec 1974. Translated by M. Olaechea from pp 591-596 of Gorenie i Vzryv, Moscow, 1972. (FTD-HT-23-1995-74). 16p. NTIS $3.25.

1342 (GERHTR-135) INFLUENCE OF THE METHOD OF MEASUREMENT ON THE OPTICAL ANISOTROPY FACTOR OPTAF OF PYROCARBON. Koizlik, K.; Taeuber, K.; Nickel, H.; Wasmund, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jul 1974. Translation of JUL-1082-RW. 26p. Dep. NTIS $4.50.

Work performed under United States–German High Temperature Reactor Research Exchange Program.

This study describes the development and installation of an automatic microscope photometer for the measurement of the optical anisotropy factor OPTAF on the pyrocarbon coatings of fuel particles. After a short representation of the physical basis of this procedure the new microscope photometer is introduced. First measurements for the adaptation of the new instrument of the so far used microscope photometer are discussed. By these measurements the influence of the instrument on the value of OPTAF in the case of some special ways of measuring are explained and the appearance of an apparent anisotropy is interpreted. (auth)

1343 (IEA-355) DIPOLE ORIENTATION EFFECTS IN RARE-EARTH DOPED CdF_2. Capelletti, R.; Fermi, F.; Okuno, E. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Sep 1974. 15p. Dep. NTIS (US Sales Only) $4.00.

A number of experiences carried out by means of ionic thermoconductivity technique in the temperature range 80 to 200°K shows

unequivocally that n.n. Rare Earth Fluorine Interstitial (RE-FI) dipole reorientation occurs in CdF_2: Eu, resolving the puzzle of the lack of this kind of relaxation in trivalent ion-doped CdF_2, as reported by previous authors. The activation energy for orientation (ϵ = 0.40 eV) and the preexponential factor ($\tau_0 = 10^{-12}$ s) are evaluated for the principal ITC peak (T_M = 152.5°K) discussed and compared with the analogous parameters in Eu doped Ca and Sr fluorides. Other ITC peaks at 168 and 186°K are also analyzed. A parallel study on CdF_2: Gd shows that electronic effects are not negligible and can mask dispolar relaxations. The difference between Eu and Gd is discussed. (auth)

1344 (JUL-1216) APPLICATION OF QUANTITATIVE IMAGE ANALYSIS TO THE CHARACTERIZATION OF PYROCARBON. Kolzlik, K.; Hoven, H.; Luhleich, H.; Cremerius, M.; Bruch, K. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jul 1975. 71p. (In German). Dep. NTIS (US Sales Only) $5.50.

Pyrocarbon used as a coating material for HTR fuel kernels has proved to be a very variable and complex material. In order to describe it concerning its properties and operational possibilities it is necessary to apply a lot of different characterization procedures to this material. Two methods which have been developed recently are wet and plasma oxidation. To quantify their information, it has become necessary to use quantitative ceramography, in this special case quantitative image analysis. This paper describes the equipment, characterization parameters, and the errors which can arise when characterising pyrocarbon by this instrument. Finally, first experimental results are discussed. (auth)

1345 (JUL-1221) COAT-MIX-PROCESS: A NEW PROCESS FOR THE PRODUCTION OF FILLER-BINDER-MIXTURES. Luhleich, H.; Dias, F.; Pflaum, P.; Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jul 1975. 31p. (In German). Dep. NTIS (US Sales Only) $5.00.

A new process is described, for overcoating filler materials, very homogeneously, with phenol formaldehyde binders. In addition, pressureless molding processes which have been developed for powders produced by the coat-mix-process are discussed. (auth)

1346 (N-75-17478) STUDY OF THE DIFFUSIONAL BEHAVIOR OF A TWO-PHASE METAL MATRIX COMPOSITE EXPOSED TO A HIGH-TEMPERATURE ENVIRONMENT. Final report. Tenney, D. R. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Div. of Minerals Engineering). 1974. 54p. (NASA-CR-136751). NTIS $4.25.

The progress of diffusion-controlled filament-matrix interaction in a metal matrix composite where the filaments and matrix comprise a two-phase binary alloy system was studied by mathematically modeling compositional changes resulting from prolonged elevated temperature exposure. The analysis treats a finite, diffusion-controlled, two-phase moving-interface problem by means of a variable-grid finite-difference technique. The Ni–W system was selected as an example system. Modeling was carried out for the 1000 to 1200°C temperature range for unidirectional composites containing from 6 to 40 volume percent tungsten filaments in a Ni matrix. The results are displayed to show both the change in filament diameter and matrix composition as a function of exposure time. Compositional profiles produced between first and second nearest neighbor filaments were calculated by superposition of finite-difference solutions of the diffusion equations. (auth)

1347 FORMATION CONDITIONS AND PROPERTIES OF CADMIUM-CONTAINING FERRITES. Levin, B. E.; Nazarchik, N. A.; Malegin, Yu. V. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 5, 132-135(1974). (In Russian).

For English translation of selected articles see the journal Stal USSR.

A study was made of the charge sinterability, microstructure, and electromagnetic properties of ferrites having the general formula $Li_{0.3}Zn_{0.6-x}Cd_xFe_{2.1}O_4$. A study of the mechanism of synthesis showed that the introduction of cadmium ions to replace zinc activates the sintering process without hardly changing the temperature of initial ferritization. Results are presented of a study of the microstructure of samples sintered at various temperatures. A tendency is noticed to an increase in grain size on increasing the content of cadmium ions in the material. A concentration dependence was established for a number of the properties of the materials under study. (tr-auth)

1348 X-RAY-DIFFUSE-SCATTERING EVIDENCE FOR A A PHASE TRANSITION IN TETRATHIAFULVALENE TETRACYANOQUINODIMETHANE (TTF-TCNQ). Denoyer, F.; Comès, F. (Laboratoire de Physique des Solides, Université Paris-Sud, 91405 Orsay, France); Garito, A.F.; Heeger, A.J. Phys. Rev. Lett. 35: No. 7, 445-449 (18 Aug 1975).

X-ray-diffuse-scattering measurements of tetrathiafulvalene tetracyanoquinodimethane (TTF-TCNQ) show structural evidence of a phase transition. The low-temperature three dimensional superlattice ($2a \times 3.7b \times Xc$) is found to be preceded above 40 K by one-dimensional fluctuations or a one-dimensional distortion visible up to 55 K. (auth)

1349 HOPPING CONDUCTION BETWEEN IMPURITIES IN *n*-TYPE InP. Emel'yanenko, O.V.; Masagutov, K.G.; Nasledov, D.N.; Timchenko, I.N. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad). Sov. Phys.—Semicond. 9: No. 3, 330-333 (Sept 1975).

An investigation was made of the interimpurity conduction in *n*-type InP crystals with shallow donor concentrations $N_D = 3 \cdot 10^{15} - 4.5 \cdot 10^{16}$ cm^{-3}. At temperatures 2–4 °K the conduction was mainly of the hopping nature and it obeyed qualitatively the percolation theory: The resistivity was $\rho_3 = \rho_0 \exp[1.9(N_D{}^{1/3}a)^{-1}]$ and in magnetic fields $H \leq 28$ kOe this resistivity varied in accordance with the law $\exp(\text{const } H^2)$, where the theoretical coefficient t included in the "const" factor was equal to 0.04 for pure samples; in the $N_D \geq 10^{16}$ cm^{-3} range the value of t rose to 0.06–0.08, which was probably due to the broadening of the impurity band. The resistivity ρ_0 of *n*-type InP and several other crystals (*n*-type GaAs, *p*-type Ge, *p*-type Si, *p*-type InSb) obeyed the theoretical parametric dependences but the absolute resistivity was 20–40 times greater than the calculated value. (auth)

1350 SWITCHING IN COMPENSATED CADMIUM TELLURIDE SINGLE CRYSTALS. Agrinskaya, N.V.; Alekseenko, M.V.; Matveev, O.A. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad). Sov. Phys.—Semicond. 9: No. 3, 341-343 (Sept 1975).

A study was made of the switching effect in compensated CdTe crystals which were either doped with donors or left undoped. The dependences of the switching field on the thickness of the sample, delay time, and temperature were determined. The switching was nonthermal in thin samples ($\lesssim 100\ \mu$). The current-voltage characteristics of the majority of the samples could be described satisfactorily by the law $I \propto \exp(-E_0/E)^{1/4}$, which was deduced for the hopping conduction in heavily doped semiconductors subjected to strong electric fields. It was concluded that the high-field conduction was not governed by the bulk properties of the sample but by the channels with the highest density of impurity states. (auth)

1351 PROFILES OF RADIATION DAMAGE AND IMPLANTED BORON IN SILICON. Dikii, N.P.; Matyash, P.P.; Skakun, N.A. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov). Sov. Phys.—Semicond. 9: No. 3, 395-396 (Sept 1975).

The distributions of displaced silicon atoms after irradiation by boron ions at 50 keV is reported. (AIP)

1352 BOR: POLUCHENIE STRUKTURA I SVOISTVA. (Boron: Production, Structure, and Properties). Fourth International Symposium on Boron, Tbilisi, USSR, October 9–15, 1972). Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). 267p. (CONF-7210132–P1).

Some of the papers presented at the conference are compiled. They report research on properties and production of boron and the higher borides. The physical-chemical, electrical, optical, and mechanical properties were examined. Abstracts were prepared for the individual papers. (JSR)

For abstracts of individual papers see: 1, 66, 1137–1156, 1311, and 1353–1382.

1353 STATUS AND BASIC TRENDS IN STUDIES ON PRODUCTION METHODS, STRUCTURE, AND PROPERTIES OF BORON. Samsonov, G. V.; Tsagareishvili, G. V. (Inst. of Problems in Metal Science, Kiev). pp 5-14 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132–P1.

A review is given of data on the production and properties of B. The present status and basic trends in research on this element are analyzed. (87 references) (tr-auth)

1354 PREPARATION OF BORON BY REDUCTION OF BORON TRICHLORIDE BY HYDROGEN IN A PLASMA TORCH. Cueilleron, J.; Cruiziat, B. pp 15-17 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132–P1.

Boron trichloride, hydrogen, and argon are injected in an induction plasma torch. The plasma is produced in a quartz apparatus which is cooled by a stream of water. The frequency is 5 megahertz and the energy is 10 kW. The flows of gas are: argon,

15 liters per minute, hydrogen 1 to 1.5 liter per minute, boron trichloride 10^{-3} to 10^{-6} gram-molecule per minute. The boron yield, in comparison to boron chloride, reaches from 70 to 75%. The boron analysis, which is by emission spectrography, gives for Si, C, Al, Mg, Cu, Fe, Ni, Cr, and Mn a total result lower than 0.3%. The gas extraction in vacuo at elevated temperature gives 20 to 25 ppM for nitrogen, 200 to 1000 for oxygen and 100 to 500 for hydrogen. (auth)

1355 CRYSTALLIZATION OF AMORPHOUS BORON. Ugai, Ya. A.; Solov'ev, N. E.; Averbakh, E. M.; Parfenov, A. N. (Lenin State Univ., Komsomola, USSR). pp 18-23 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

A study was made of the conditions for the crystallization of amorphous B in the interval from 800 to 2200°C in Ar medium at atmospheric pressure. The possibility of obtaining β-B during induction heating with preliminary plasma preheating was shown. It was established that under appropriate conditions the crystallization of amorphous B leads to the formation of α-B. The presence of the suboxide $B_{13}O_2$ promotes this process. The results of x-ray, optical, and thermographic analyses were reported. (tr-auth)

1356 TRANSITION OF AMORPHOUS BORON TO THE CRYSTALLINE STATE. Pirtskhalaishvili, R. M.; Bairamashvili, I. A.; Samkurashvili, T. V.; Lomidze, G. P.; Loladze, Sh. A.; Gudushauri, N. I. (Inst. of Metallurgy, Tbilisi, USSR). pp 23-26 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Results of the study of the kinetics of the structural conversion of amorphous B into the crystalline state in the temperature interval from 1000 to 2000°C in vacuum were reported. (tr-auth)

1357 NATURE OF THE ANOMALIES OF THE PROPERTIES OF BORON CRYSTALS. Tsagareishvili, G. V. (Inst. of Metallurgy, Tbilisi, USSR). pp 51-53 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The singularities of the properties of B were examined from two aspects — electronic and atomic. The possibility of considering the β-rhombohedric modification as a solid solution of B in B formed from B atoms with different configurations of the valence electrons was suggested. The presence of phase conversions connected with electron transitions was hypothesized. The presence of an isotopic effect in B was also proposed. (tr-auth)

1358 X RAY AND ELECTRON MICROSCOPIC STUDY OF CRYSTALS OF β-RHOMBOHEDRIC B. Antadze, M. E.; Rozhanshii, V. N.; Tsagareishvili, G. V.; Tavadze, F. N. (Inst. of Metallurgy, Tbilisi, USSR). pp 54-58 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow: Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Standard stereographic projections were constructed for some planes of β-rhombohedric B. The fine structure of B crystals was studied. The presence of dislocations and twins in large quantity was established. The twinning plane was determined. It was shown that plastic deformation of the samples at high temperatures is accompanied by twinning along the rhombohedric planes. (tr-auth)

1359 TRANSFORMATIONS IN CRYSTALLINE BORON DURING MECHANICAL DISPERSION. Tsomaya, K. P.; Samsonov, G. V.; Tavadze, F. N. (Inst. of Metallurgy, Tbilisi, USSR). pp 58-63 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The effect of fine mechanical dispersions on the phase composition of B prepared by different methods was studied. It was established that during the fine dispersion of B precipitated from the gaseous phase one of the phase components is amorphized. (tr-auth)

1360 SOME ABNORMAL ELECTROPHYSICAL PROPERTIES OF BORON AT HIGH TEMPERATURES. Adirovich, E. I.; Gulyamov, K. B.; Muminov, A.; Sultanov, M. (Physical-Mechanical Inst., Tashkent). pp 63-65 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Endoeffects close to 100, 150, and 300°C were observed in powders of crystalline B during differential thermal analyses. The conditions for the appearance of these thermoeffects were determined. It was shown in particular that they depend on the previous annealing regime. Hypotheses were made on the causes for the appearance of these effects. (tr-auth)

1361 ENTHALPY OF β-RHOMBOHEDRIC BORON IN THE TEMPERATURE INTERVAL FROM 300 TO 640°K. Tsagareishvili, G. V.; Tsagareishvili, D. Sh.; Tsikaridze, D. N.; Zhgenti, N. M.; Tavadze, F. N. (Inst. of Metallurgy, Tbilisi, USSR). pp 65-69 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The enthalpy of zone-purified coarse crystalline samples of β-rhombohedric B was studied by the method of mixing in a massive calorimeter having an isothermal casing at 300 to 640°K. It was shown that the temperature pattern of the enthalpy has complex and saturation anomalies. (tr-auth)

1362 FIELD EFFECT IN β-RHOMBOHEDRAL BORON. Szadkowski, A.; Zareba, A. (Inst. of Physics, Warsaw). pp 69-72 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Field effects (FE) in crystalline, β-rhombohedral boron of high purity were investigated. The temperature dependence of the FE was measured in temperature range 130 to 330°K. The relaxation of FE and the dependence of the effect on applied field were studied. Because of slow relaxation, the FE were always measured by a single pulses method. The sign of FE indicates, that the moving carriers are predominately holes. The measurements give, under some reasonable and simple assumptions, the value of the effective mobility (at room temperature about $1 \times 10^{-3} cm^2 V^{-1} s^{-1}$) and its temperature dependence. The temperature dependence of mobility agrees with that found from measurements of frozen in photoconductivity. Below about 230°K the effective mobility is proportional to the electrical conductivity, which suggests, that at lower temperatures, the variation of the conductivity with temperature is caused by the temperature dependence of the effective mobility only. (auth)

1363 MECHANISM AND QUANTITATIVE DESCRIPTION OF THE PHOTOCONDUCTIVITY AND PHOTO-EPR IN β-RHOMBOHEDRAL BORON SINGLE CRYSTALS AT 77°K. Geist, D. (Technische Univ., Clausthal, Ger.). pp 72-74 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The inhomogeneous excitation resulting from strong absorption of the incident light as well as the low carrier mobility resulting in nearly negligible diffusion is taken into account in converting data on conductance and number of spins into a time-of and intensity-of illumination dependence of the concentrations of localized states and carriers. Then a model as simple as possible is developed which explains simultaneously the behavior of the conductivity and density of carriers and spin carrying centers. The resulting four coupled nonlinear differential equations have been solved analytically and numerically. Within the accuracy of the measurements, the observations can be reproduced entirely. (auth)

1364 ELECTRICAL CONDUCTION AND SWITCHING IN β-RHOMBOHEDRAL BORON. Prudenziati, M. (Univ., Modena, Italy). pp 74-82 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Electrical conductivity, thermally stimulated currents, photoconductivity, and switching effects have been investigated in β-rhombohedral boron at 77 to 500°K. The compensated nature of boron is shown by the electrical conductivity. Data on thermally stimulated currents, photoconductivity and space charge limited currents are used to identify the energy location of trapping centers for electrons and holes separately. Features of the switching mechanism have been analyzed by means of the threshold voltage dependence on the temperature, in the dark and under light. Light emission in the negative differential resistivity regions was observed. (auth)

1365 MECHANISM OF SPECIFIC ELECTRICAL CONDUCTIVITY AT LOW TEMPERATURES IN BORON. Zareba, A. (Inst.

of Physics, Warsaw). pp 82-85 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The transport phenomena such as electrical conductivity, thermoelectric power, magnetoconductivity were studied in high-purity β-rhombohedral boron at low temperatures. Measurements were carried out in the state of frozen in photoconductivity, after previous photoexcitation. Two components of conductivity were observed. Both are characterized by activation energy of mobility. The atypical magnetoconductivity, found in boron, is interpreted as the influence of magnetic field on the component of conductivity, dominating at low temperatures. The value of mobility and its activation energy vary with the concentration of photoinduced carriers. A model of the hopping mechanism, explaining the observed effects, is proposed. The existence of two kinds of valence localized states is postulated. It is suggested that localization of states is due to the specific, very complicated structure of boron. (auth)

1366 ABNORMAL CHANGES IN THE ELECTRICAL RESISTANCE AND OPTICAL ABSORPTION IN β-BORON. Anisimov, B. B.; Dzhamagidze, S. Z.; Shvangiradze, R. R. (Inst. of Metallurgy, Tbilisi, (USSR). pp 86-87 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

A simultaneous measurement was made of the temperature dependence of the coefficient of optical absorption behind the edge of the fundamental band and of the electric resistance on tempered samples of β-B. In the region of 300°C complete correlations were observed in the abnormal changes of these values, which indicated the uniformity of the causes inducing these changes. Possible causes for the abnormal effects detected were discussed. (tr-auth)

1367 ELECTRON TRAPPING IN β-RHOMBOHEDRAL BORON. Nadolny, A. J. (Inst. of Physics, Warsaw). pp 88-91 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

On the basis of investigations of kinetics of photoconductivity in the temperature range 200 to 333°K a model of electron trapping processes in β-rhombohedral boron is proposed. Two groups of traps (A) and (B) with different values of capture coefficient are postulated. The activation energies of emptying of traps of each group are continuously distributed in a certain energy range with a defined distribution function. The ranges of emptying energies and capture coefficients have been determined from the fitting of the computed functions to the experimental data. The estimated trap concentrations of both types A and B are of the order of 10^{17} to $10^{18}cm^{-3}$ and $10^{16}cm^{-3}$, respectively, and approximately correspond to the impurity concentrations. The theoretical time dependences of photoconductivity for various temperatures based on the model are in a good agreement with the experimental curves of rise and decay of photoconductivity. Many other phenomena observed in β-rhombohedral boron, such as thermostimulation, photoabsorption, intensity—and spectral dependences of photoconductivity may also be explained on the basis of the model. (auth)

1368 ELECTRIC CONDUCTIVITY OF β-RHOMBOHEDRIC BORON IN A STRONG ELECTRIC FIELD. Berezin, A. A.; Zaitsev, V. K.; Kazanin, M. M.; Tkalenko, E. N. (Ioffe Inst. of Physics and Tech., Leningrad). pp 91-97 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The volt-ampere characteristics of zone-melted β-rhombohedric B was investigated at 77, 113, 205, and 293°K in fields up to 60 kV/cm. The observed dependence of the electric conductivity on the field intensity was explained by the Frenkel-Pool effect for screened Coulomb centers. The coefficients and drift mobility of the carriers were determined for these temperatures. It was found that the activation energy of the carriers with trapped levels on the current carriers is close to 0.05 eV and the concentration of traps is 10^{17} to $10^{18}cm^{-3}$. (tr-auth)

1369 ELECTRICAL PROPERTIES OF β-RHOMBOHEDRIC AND AMORPHOUS BORON. Berezin, A. A.; Golikova, O. A.; Zaitsev, V. K.; Stil'bans, L. S.; Khomidov, T. (Ioffe Inst. of Physics and Tech., Leningrad). pp 106-110 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Data were reported on the temperature dependence of the electric conductivity and the thermo emf of β-rhombohedric and amorphous B. It was noted that the complex structure of the crystalline cell of β-B makes it in relation to a series of kinetic phenomena similar to amorphous materials. The singularities of the energy dependence of the density of the state close to the boundary of the valence zone for amorphous semiconductors and β-rhombohedric B were examined. The electric conductivity of β-B was also examined from the viewpoint of the theory of small radius polarons. (tr-auth)

1370 OPTICAL ABSORPTION AND PHOTOEFFECT IN β-RHOMBOHEDRIC BORON, AMORPHOUS BORON, AND BORON CARBIDE. Werheit, H.; Binnenbruck, H. (Univ., Cologne). pp 110-115 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

On the basis of an analysis of optical measurements conclusions were drawn on the nature of the absorption spectra of β-B, boron carbide, and amorphous B. The similarities between the transfer properties of crystalline B and amorphous semiconductors can be extended to the optical properties only to known limits. The transition from crystalline to amorphous B does not explain the amplification of the special optical properties of crystalline B. (tr-auth)

1371 COLD EMISSION OF BORON ON TUNGSTEN. Ownby, P. D.; Fleim, T. A. (Univ. of Missouri, Rolla). pp 115-121 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The change of the work function during adsorption of thin layers of B on W corresponds to a theoretical model based on the difference in the electronegativity between the atoms of the adsorbent and substrate and on the dipole-dipole interactions. With an emission microscope it was established that at a high degree of deposition the (110) plane of the W filaments are coated by crystalline B. As a result, stability of the emitter spikes was increased. The possibility of using these emitters for electronic devices was discussed. (tr-auth)

1372 MECHANICAL PROPERTIES OF CRYSTALS OF β-RHOMBOHEDRIC BORON. Tsagareishvili, G. V.; Khvedelidze, A. G.; Berezhkova, G. V.; Govorkov, V. G.; Voinova, N. N. (Inst. of Metallurgy, Tbilisi, USSR). pp 121-125 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi USSR (9 Oct 1972). See CONF-7210132-P1.

The temperature dependence of the microhardness of β-rhombohedric B crystals was studied in the temperature interval from 20 to 900°C. Models of normal elasticity and shear were determined for room temperature. The actual structure arising as a result of the deformation of β-B crystals at high temperatures was studied. (tr-auth)

1373 ACOUSTICAL PROPERTIES OF β-RHOMBOHEDRIC BORON. Sil'vestrova, I. M.; Belyaev, L. M.; Nemysskii, T.; Pisarevskii, Yu. V. (Inst. of Crystallography, Moscow). pp 125-128 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi USSR (9 Oct 1972). See CONF-7210132-P1.

Data were obtained on the velocities and absorption of sound in monocrystalline β-rhombohedric B in the frequency range from 0.4 to 1.5 GHz. Data were reported on some semiconductor properties and the actual structure of this crystal. (tr-auth)

1374 MECHANISM OF RELAXATION PROCESSES IN BORON. Darsavelidze, G. Sh.; Khachapuridze, R. A.; Tavadze, F. N. (Inst. of Metallurgy, Tbilisi, USSR). pp 129-130 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Possible mechanisms of processes of the damping of the energy of mechanical oscillation in B, observed in the temperature interval from 80 to 1000°K, were discussed. (tr-auth)

1375 MASS SPECTROMETRY, OPTICAL ABSORPTION, AND ELECTRICAL PROPERTIES OF AMORPHOUS FILMS OF BORON. Feldman, C.; Moorjani, K.; Blum, N. (John Hopkins Univ., Silver Springs, MD). pp 130-132 pf Bor: Poluchenie

Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

A method was described for obtaining pure films of B. The results of mass spectrometric studies and of the analysis of B ion clusters both in amorphous films and in massive material were reported. The electroconductivity and optical absorption of comparatively pure samples were discussed. (tr-auth)

1376 STRUCTURE OF CONDENSED FILMS OF BORON. Palatnik, L. S.; Nechitailo, A. A.; Koz'ma, A. A.; Fuks, M. Ya.; Tsomaya, K. P. (Lenin Polytechnical Inst., Kharkov). pp 139-142 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi USSR (9 Oct 1972). See CONF-7210132-P1.

The structure of B films was studied as a function of the conditions of condensation and annealing. Structural analyses showed that the films obtained at T < 550°C have an amorphous structure consisting of icosahedrons. In condensates precipitated on substrates with W sublayers, at very high temperatures of the substrate heterogeneous mixtures of amorphous and tetragonal B were observed. During annealing of the films of amorphous B their crystallization into the β-rhombohedric modification occurred. Transformation occurs at the annealing temperature as a function of the conditions of preparation of the films. (tr-auth)

1377 PREPARATION OF STRUCTURAL STUDY OF THIN BORON FILMS. Samkurashvili, T. V.; Bairamashvili, I. A.; Alaksandriya, B. V. (Inst. of Metallurgy, Tbilisi, USSR). pp 142-144 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The results of the study of the structure of thin films of B deposited on heated substrates were reported. Electron-graphic phase analyses showed that B films deposited on Si and sapphire, heated to 800°C, were amorphous. With temperature increase, the semicrystalline phase appeared and at temperatures of 850 to 900°C crystalline B was formed completely. At higher temperatures there is interaction between the Si, B vapor, and C in the residual gas with the formation of SiC, SiB_4, and B_4C. (JSR)

1378 LIQUID-ROLLED BORON FILMS. Tavadze, G. F.; Khantadze, D. V.; Tsagareishvili, G. V.; Tavadze, F. N. (Inst. of Metallurgy, Tbilisi, (USSR). pp 145-146 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Boron films with a thickness of 20 to 1000 μ were obtained by rolling with a rotating roller with sudden collapse of the copper disk or by centrifugation of the fused drops formed by the electron beam heating of the lower face of a vertically suspended B rod. The results of the radiographic study of the films obtained were reported. (tr-auth)

1379 STRUCTURE AND PROPERTIES OF BORON FILAMENTS. Zhigach, A. F.; Tsirlin, A. M.; Shchetilina, E. A.; Romashov, V. M.; Fedorova, T. V.; Shafranovich, E. G.; Balagurova, N. M. (Inst. of Metallurgy, Tbilisi, USSR). pp 147-154 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

Radiographic and metallographic studies were made of B filaments. The average dimension of the crystallites of the B layer was determined. A study was made of the morphology of the surface of the filaments and fractographic studies were made of the site of the break on batches of filaments having different strengths. The nature of the stability of B filaments in comparison with other high-stability materials was examined. (tr-auth)

1380 INTERNAL FRICTION IN BORON FILAMENTS. Tsagareishvili, G. V.; Dugladze, G. M.; Darsavelidze, G. Sh.; Tavadze, F. N. (Inst. of Metallurgy, Tbilisi, USSR). pp 154-156 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow: Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The temperature dependence of the internal friction and the shear modulus in B filaments was examined at a frequency of 1 Hz at an amplitude of relative deformation of the order of 5×10^{-5}. On the $Q^{-1}(T)$ curve relaxation peaks were observed in the areas of 230 and 650°K with activation energies corresponding to 0.64 and 2.36 eV, respectively. Possible mechanisms for the formation of these peaks were discussed. (tr-auth)

1381 PHYSICO-CHEMICAL PROPERTIES OF BORON AND PROSPECTS FOR THE CREATION OF B-BASED SEMICONDUCTOR DEVICES. Nekrasov, M. M.; Tsomaya, K. P. (Inst. of Metallurgy, Tbilisi, USSR). pp 157-159 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi USSR (9 Oct 1972). See CONF-7210132-P1.

The physicochemical properties of B are examined with respect to the prospects for the fabrication of B-based semiconductor devices using the method of pulsed electric welding of the metallic contact directly to the B crystals. (tr-auth)

1382 SYNTHESIS AND SOME PROPERTIES OF SUBARSENIDES OF BORON. Radchenko, A. F.; Medvedeva, Z. S. (Inst. of General and Inorganic Chemistry, Moscow). pp 225-228 of Bor: Poluchenie Struktura i Svoistva. Tavadze, F. N. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian)

From 4th international synposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P1.

The conditions for the synthesis of powders of boron subarsenide were investigated on the basis of a study of the kinetics of the interaction of amorphous B with As vapor. The structural and electrophysical characteristics of the boron subarsenide prepared were studied. (tr-auth)

1383 BOR: POLUCHENIE, STRUKTURA I SVOISTVA. (Boron: Production, Structure, and Properties. 4th International Symposium on Boron, Tbilisi, USSR, October 9-15, 1972). Tbilisi, USSR; Izdatel'stvo Metsnichereba (1974). 175p. (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972).

See CONF-7210132-P2.

Some of the papers presented at the Symposium are compiled. They report research on the properties and production of boron and borides. Individual abstracts were prepared for selected papers. (JSR)

For abstracts of individual papers see: 16, 1157-1165, and 1384-1388.

1384 THEORY OF THE THERMAL CONDUCTIVITY OF CRYSTALLINE BORON. Logachev, Yu. A. (Ioffe Physico-Technical Inst., Leningrad). pp 19-24 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

An explanation is proposed for the anomalous temperature dependence of the thermal conductivity of β-rhombohedral boron on the basis of the ordinary concepts of phonon-phonon scattering in complex lattices. The stronger than T^{-1} dependence of the thermal conductivity at T < 400°K is connected with the role of the optical phonons in the scattering of the acoustic phonons, and the plateau on the $\kappa(T)$ curve in the T ~ 1000°K range is connected with the role of the optical branches in the heat transfer. The thermal conductivity decreases as T^{-1} at higher temperatures. The possibility of heat transfer by localized excitations (analogously to the heat transfer in amorphous substances) is analyzed. Experiments are outlined, the results of which would permit an answer to be obtained to the question of the mechanism of heat transfer. These experiments include measurement of the high temperature thermal conductivity of amorphous boron and infrared experiments in a broader frequency range. (auth)

1385 ANALYSIS OF THE DEBYE TEMPERATURE OF BORON FROM ITS THERMAL AND ELASTIC PROPERTIES. Bogdanov, V. I.; Vekilov, Yu. Kh.; Tsagareishvili, G. V. (Inst. of Steel and Alloys, Moscow). pp 33-36 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

The dependence $\theta(T)$ for β-B was analyzed from data on the heat capacity obtained at 16 to 280°K. It was assumed that the critical dependence of θ at T < 35°K can be connected with the effect of heavy impurity atoms on the oscillation spectrum of β-B. From the dependence $C_V(T)$ the limiting value of the Debye temperature corresponding to the long-wave part of the oscillation spectrum of the lattice was calculated. For β-B θ = 1220°K. This value was compared with the values of the Debye temperature determined from the elastic properties. The size of θ_0 reflects the actual forces acting between the atoms in the solid state. The values of θ_0 of β-B and a series of semiconductors (Si, Ge, CaAs, GaSb, InSb, InAs, and HgSe) were compared. An evaluation was made from data on the heat capacity of β-B of the x-ray characteristic temperature usually used in the discussion of results on the diffusion scattering of x rays and the Moessbauer effect. (tr-auth)

1386 RESULTS OBSERVED DURING THE RADIOGRAPHIC STUDY OF BORON. Tsomaya, K. P.; Tavadze, F. N. (Inst. of Metallurgy, Tbilisi, USSR). pp 66-72 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

Radiographic studies were made on B obtained by thermal dissociation of BBr_3, zone meltings, and electrolysis of the fused salt mixture KBF_4 and KF. The effect of annealing and fusion on the crystallization of B was also studied. In B obtained by thermal dissociation the appearance of some structural forms as a function of the preparation conditions was observed. A change of the relative intensity in the interference lines of x-ray diffraction lines was observed in zone melted B. Boron obtained by electrolysis can be contaminated by the reaction products which can be the source of errors during the radiographic analysis. In amorphous B, with increase of the annealing temperature, the quantity of the crystalline phase of the β-rhombohedric modification is increased. B or any modification, independent of the method of preparation and its state (crystalline or amorphous), converts into the β-rhombohedric modification after remelting. (tr-auth)

1387 EFFECT OF HIGH HYDROSTATIC PRESSURE ON THE PHOTOELECTRIC PROPERTIES OF B CRYSTALS. Adirovich, E. I.; Abdullaev, Ya. S.; Gulyamov, K. V.; Muminov, A.; Sultanov, M. (Physical-Technical Inst., Tashkent). pp 73-81 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7212132-P2.

The effect of high pressure on the photoconductivity and dark conductivity of B crystals was studied at pressures up to 6 kbar for the photoconductivity and 10 kbar for the dark conductivity. For the photoconductivity higher pressures lead to a marked growth of the photoconductivity, displacement of the photoconductivity maximum, and changes in the form of the spectral distribution curve. The maximum is displaced to the long-wave spectral region. The dark conductivity also increases under pressure but to a much lesser degree than the photoconductivity. The mechanism responsible for the change of the conductivity is discussed. (JSR)

1388 STUDY OF β-RHOMBOHEDRIC BORON AS AN ABRASIVE MATERIAL. Samsonov, G. V.; Adamovskii, A. A.; Bezykornov, A. I.; Nemtsova, N. Ya.; Uvarov, V. V.; Tsagareishvili, G. V.; Tsomaya, K. P. (Inst. of Problems in Materials, Kiev). pp 82-96 of Bor: Poluchenie, Struktura i Svoistva. Tbilisi, USSR; Izdatel'stvo Metsniereba (1974). (In Russian).

From international symposium on boron; Tbilisi, USSR (9 Oct 1972). See CONF-7210132-P2.

The geometric parameters, strength, abrasive capacity, and wear resistance of grains of β-B during microcutting of Ti and Ni were studied and compared with other abrasive materials. With increase of the granularity, the fraction of sharp angles increased, the rounding radius and the angle of sharpening decreased, and the total quantity of sharp angles decreased. The effect of impurities on the abrasive properties of β-rhombohedric B is insignificant. (JSR)

1389 RADIATION DEFECTS IN SILICON DUE TO IONS N^+ AND Te^+ IMPLANTATION. Orel, V. (Prirodovedecka Fakulta UJEP, Brno). Cesk. Cas. Fys.; 25: No. 4, 376-379(1975). (In Czech).

Several results of the transmission electron microscopy observation and electron diffraction of silicon single crystals implanted by the dose from 1×10^{13} cm^{-2} to 1×10^{15} cm^{-2} of N^+ and Te^+ ions with the energy 30 keV are shown. The results induce the conclusion that, due to ion implantation at room temperature, small regions with a higher concentration of defects are generated in silicon and have an amorphous structure. The discussion of a relation between the dose and the density of amorphous regions shows no simple correlation of those quantities. (auth)

1390 DIFFRACTION EFFECTS IN X-RAY-IRRADIATED NaCl SINGLE CRYSTALS. Kolontsova, E. V.; Kulago, E. E. (Moscow State Univ.). Sov. Phys. - Crystallogr.; 20: No. 1, 109-110(1975).

Translated from Kristallografiya; 20: No. 1, 184-186(1975).

The characteristics of secondary radioinduced defects in NaCl single crystals were studied. Plate form clusters were observed in irradiated crystals in (100) planes aligned in rows along (100) which correspond to the theoretical description of the form and distribution of nucleating centers of a new cubic solid solution Phase. From this, it is concluded that the irradiated crystal comprises a solid solution of point defects. (JRD)

1391 DISLOCATION MOBILITY AND THE NATURE OF THE BLOCKING CENTERS IN IRRADIATED LiF CRYSTALS. Urusovskaya, A. A.; Knab, G. G. Sov. Phys. - Crystallogr.; 20: No. 1, 57-59(1975).

Translated from Kristallografiya; 20: No. 1, 103-109(1975).

Individual dislocation speeds were measured in Mg-doped LiF crystals between 77 and 300°K for stresses of 30 to 5000 gf/mm^2. X rays at doses up to 10^4 R reduce the mobility. Irradiation has little effect on the number of blocking centers, but the activation energy increases. It is considered that radiation hardening is due to disruption of impurity–vacancy complexes and production of interstitial fluorene molecules. (auth)

1392 DARK AND GAMMA-INDUCED PHOTO CONDUCTION IN HIGH PURITY SILICON AT LOW TEMPERATURES. Precker, J. Kiel; Univ. Kiel (1973). 121p. (In German). INIS. Thesis.

The electrical properties of high purity silicon were investigated in the low temperature region in which the concentration of thermally excited charge carriers in the sample volumes can be completely neglected. The samples are n-conducting and have an impurity concentration of $N_d - N_a = 4.4 \times 10^{12}$ cm^{-3} (type A) as well as $N_d - N_a = 1.4 \times 10^{11}$ cm^{-3} (type B). They are doped with phosphorous and contain boron as impurity. The conductivity and Hall voltage depending on temperature and the electric field strength were measured each with and without irradiation. A ^{60}Co preparation having an activity of 54.2 mCi ± 15% on July 7, 1971, was used as radiation source. The intensity of the ^{60}Co source is so small that no measurable concentration of permanent damage in the silicon lattice occurs. (auth)

1393 HIGH-RESOLUTION OPTICAL MICROSCOPY OF CARBON AND GRAPHITE. Cook, W. H.; Allen, M. D.; Leslie, B. C.; Gray, R. J. (Oak Ridge National Lab., TN). pp 645-662 of Microstructural Science. Vol. III. French, P. M.; Gray, R. J.; McCall, J. L. (eds.). New York; American Elsevier Publishing Co., Inc. (1975).

The ceramographic preparation of carbonaceous materials varying in crystalline quality, amorphous carbon to well crystallized graphite, is described. In a two-step process, using alumina and diamond polishing compounds, one can prepare more samples, obtain a substantial saving in man hours, avoid rounding material around pores, and obtain flatter surfaces than were obtainable with earlier, conventional methods. Improved resolution of microstructural details is achieved without impregnation with epoxy resins or other materials to support the porous structures. Use of rotatable, half-wave retardation (sensitive tint) enhances the microstructural definition in both color and black and white. These innovations were extensively used as part of the examination of nuclear grades of graphite before and after exposure to fast neutrons at temperatures from 650 to 1100°C; typical examples are discussed. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

1394 (AAEC/IP-3) RADIOACTIVE WASTE MANAGEMENT. Alfredson, P. G.; Levins, D. M. (Australian Atomic Energy Commission, Coogee). Aug 1975. 32p. Dep. NTIS (US Sales Only) $4.75.

Present and future methods of managing radioactive wastes in the nuclear industry are reviewed. In the stages from uranium mining to fuel fabrication, the main purpose of waste management is to limit and control dispersal into the environment of uranium and its decay products, particularly radium and radon. Nuclear reactors produce large amounts of radioactivity, but release rates from commercial power reactors have been low and well within legal limits. The principal waste from reprocessing is a high activity liquid containing essentially all the fission products along with the transuranium elements. Most high-activity wastes are currently stored as liquids in tanks, but there is agreement that future wastes must be converted into solids. Processes to solidify wastes have been demonstrated in pilor plant facilities in the United States and Europe. After solidification, wastes may be stored for some time in man-made structures at or near the Earth's surface. The best method for ultimate disposal appears to be placing solid wastes in a suitable geological formation on land. (auth)

Accountability and Safeguards

Refer also to abstracts 565 and 566.

1395 (AAEC/IP-6) ILLICIT DIVERSION OF NUCLEAR MATERIALS. Bett, F. L. (Australian Atomic Energy Commission, Coogee). Aug 1975. 17p. Dep. NTIS (US Sales Only) $4.00.

This paper discusses the means of preventing illegal use of nuclear material by terrorists or other sub-national groups and by governments. With respect to sub-national groups, it concludes that the preventive measures of national safeguards systems, when taken together with the practical difficulties of using nuclear material, would make the diversion and illegal use of nuclear material unattractive in comparison with other avenues open to these groups to attain their ends. It notes that there are only certain areas in the nuclear fuel cycle, e.g. production of some types of nuclear fuel embodying highly enriched uranium and shipment of strategically significant nuclear material, which contain material potentially useful to these groups. It also discusses the difficult practical problems, e.g. coping with radiation, which would face the groups in making use of the materials for terrorist purposes. Concerning illegal use by Governments, the paper describes the role of international safeguards, as applied by IAEA, and the real deterrent effect of these safeguards which is achieved through the requirement to maintain comprehensive operating records of the use of nuclear material and by regular inspections to verify these records. The paper makes the point that Australia would not consider supplying nuclear material unless it were sugject to international safeguards. (auth)

1396 (CONF-751101--2) LINEAR FILTERING APPLIED TO SAFEGUARDS OF NUCLEAR MATERIAL. Pike, D. H.; Morrison, G. W.; Holland, C. W. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

In regard to the problem of nuclear materials theft or diversion in the fuel cycle, a method is needed to detect continual thefts of relatively small amounts of material. It is suggested that Kalman filtering techniques be used. A hypothetical material flow situation is used to illustrate the technique; losses could be detected in as few as 5 months. (DLC)

1397 (EIR-260) EXPERIENCE WITH ALPHA-AUTORADIOGRAPHY TECHNIQUES. Buetzer, P. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Sep 1975. 32p. (In German). Dep. NTIS (US Sales Only) $5.00.

α-Autoradiographs with cellulose-nitrate films are made routinely from plutonium-containing fuel after irradiation. This cheap, fast and easily operated method has been improved to allow a semiquantitative interpretation of the pictures. The film-development conditions have been changed to a potassium hydroxide solution, 6.5 N, 20 to 30°C for 5 to 30 minutes, which leads to a longer linear range of the characteristic curve. The use of an aluminium absorber between specimen and film was investigated. The optimum thickness for best resolution was determined to be 15 μm, but small deviations from that figure are not important. Using commercial quality aluminium foil to envelope the film has the additional advantage of preventing film contamination. The reproducibility of the results has been significantly improved by conditioning the films for 2 to 3 days at 40 to 50°C. Using all of these improvements, the proportionality-factor for calculation of plutonium contents using optical density figures, is at least constant over a range of about 200%. The precision is ± 7% and it can be expected to be 3 to 5% better in any one autoradiograph. (auth)

1398 (HEDL-SA--950) FFTF FUEL PIN NONDESTRUCTIVE ASSAY MEASUREMENTS. Goris, P.; DeMerschman, A. W. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Oct 1975. Contract E(45-1)-2170. 17p. (CONF-751017--10; SM--201/84). Dep. NTIS $4.00.

From symposium on safeguards of nuclear materials; Vienna, Austria (20 Oct 1975).

The Hanford Engineering Development Laboratory (HEDL) is evaluating utilization of a Cf-252 fuel pin scanner as a nondestructive assay technique to determine shipper-receiver assays of fissile materials in Liquid Metal Fast Breeder Reactor type fuel pins. All Fast Flux Test Facility fuel pins produced for cores 1 and 2 are being assayed with the fuel scanner. Results have been compared with chemical measurements. In a set of 49 pins, using 6 scans per pin, no significant differences were observed between nondestructive assay and chemical assay on 6 randomly selected pellets from each fuel pin after it had been destructed. Shipper-receiver differences for outer core fuel pins under HEDL calibration of the fuel pin scanner agree with chemical shipper-receiver differences within experimental limitations. Quality control data over a 2-year period involving 1286 observations for 7 fuel pin standards indicate a long-term random error of 0.84 percent relative standard deviation per single fuel pin assay. A random variation of S equals 0.84 percent per single fuel pin assay has little or no effect on the uncertainty in total Pu/sub f/ in statistically large numbers of fuel pins. Long-term agreement with given quality control fuel pins ranges from –0.23 percent to +0.12 percent. The overall weighted averaged agreement is –0.10 percent which indicates an apparent bias trend for the fuel pin scanner under the present two-point calibration technique. In a large number of fuel pins composing a shipment, the uncertainty for total fissile plutonium, as determined by the fuel pin scanner, is due to the uncertainty of assay of the fuel pin standards. (auth)

1399 (LA-UR-75-1711) PHYSICAL STANDARDS AND VALID CALIBRATION. Smith, D. B. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 10p. (CONF-751017-7; SM-201/19). Dep. NTIS $4.00.

From symposium on safeguards of nuclear materials; Vienna, Austria (20 Oct 1975).

The desire for improved nuclear material safeguards has led to the development and use of a number of techniques and instruments for the nondestructive assay (NDA) of special nuclear material. Sources of potential bias in NDA measurements are discussed and methods of eliminating the effects of bias in assay results are suggested. Examples are given of instruments in which these methods have been successfully applied. The results of careful attention to potential sources of assay bias are a significant reduction in the number and complexity of standards required for valid instrument calibration and more credible assay results. (auth)

1400 (SAND-75-8685) NUCLEAR ENERGY TECHNOLOGY TRANSFER: THE SECURITY BARRIERS. Rinne, R. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). Aug 1975. Contract AT(29-1)-789. 25p. (CONF-750682-1). Dep. NTIS $4.25.

From advanced study institute for industrial technology transfer; Les Arcs, Bourg St. Maurice, France (22 Jun 1975).

The problems presented by security considerations to the transfer of nuclear energy technology are examined. In the case of fusion, the national security barrier associated with the laser and E-beam approaches is discussed; for fission, the international security requirements, due to the possibility of the theft or diversion of special nuclear materials or sabotage of nuclear facilities, are highlighted. The paper outlines the nuclear fuel cycle and terrorist threat, examples of security barriers, and the current approaches to transferring technology. (auth)

1401 IAEA SAFEGUARD SYSTEM DEVELOPMENT IN CONNECTION WITH NON-PROLIFERATION TREATY. Chapter 5. Shmelev, V. M. pp 126-140 of Atom and Peace. Non-Proliferation Treaty and International Atomic Energy Agency. Morokhov, I. D. (ed.). Moscow; Mezhdunarodnye Otnosheniya (1974). (In Russian).

Special features of the procedure for guaranteeing control of nuclear materials in water-water and boiling water reactors at nuclear fuel manufacturing and reprocessing plants are discussed, different control methods are considered, and the need for developing technological means and methods for controlling nuclear materials to ensure effective control are examined. The need for an international network of analytical laboratories which would analyze samples on a contract basis for IAEA is noted. (tr-INIS)

1402 CONCEPTS OF REAL TIME AND SEMI-REAL TIME MATERIAL CONTROL. Lovett, J. E. Nucl. Mater. Manage.; 3: No. 4, 24-30(Win 1975).

After a brief consideration of the traditional material balance accounting on an MBA basis, this paper explores the basic concepts of real time and semi-real time material control, together with some of the major problems to be solved. Three types of short-term material control are discussed: storage, batch processing, and continuous processing. (DLC)

1403 MATERIALS AND PLANT PROTECTION STANDARDS: REVISITED. Powers, J. A.; Norderhaug, L. R. Nucl. Mater. Manage.; 3: No. 4, 31-35; 42(Win 1975).

AEC regulation amendments for physical protection of nuclear plants and materials are discussed. Development of industrial standards in the field of safeguards is considered and the need for increased effort pointed out. Materials and plant protection guides and high-priority standards are listed. (DLC)

1404 SOME THOUGHTS ON RANDOM ERRORS, SYSTEMATIC ERRORS, AND BIASES. Jeach, J. L. Nucl. Mater. Manage.; 3: No. 4, 37-39(Win 1975).

Measurement errors in the area of special nuclear materials accountability are discussed. Terminology of errors (random, systematic, bias) and error propagation are treated and an attempt is made to clear up the confusion. (DLC)

1405 SOME THOUGHTS ON "SOME THOUGHTS ON RANDOM ERRORS, SYSTEMATIC ERRORS, AND BIASES" BY JOHN L. JEACH. Moore, R. H. (Los Alamos Scientific Lab., NM). Nucl. Mater. Manage.; 3: No. 4, 40-41(Win 1975).

A complete system is described for calculating the actual routine inspection efforts for any nuclear fuel fabrication facility. Annual inspection efforts for facilities in Japan are calculated. (DLC)

Disposal and Storage

Refer also to abstracts 159 and 160.

1406 (AAEC/E-364) WASTES AND WASTE MANAGEMENT IN THE URANIUM FUEL CYCLE FOR LIGHT WATER REACTORS. Costello, J. M. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Aug 1975. 48p. Dep. NTIS (US Sales Only) $5.50.

The manufacturing processes in the uranium fuel cycle for light water reactors are described with particular reference to the chemical and radiological wastes produced and the waste management procedures employed. The problems and possible solutions of ultimate disposal of high activity fission products and transuranium elements from reprocessing of irradiated fuel are reviewed. Quantities of wastes arising in each stage of the fuel cycle have been summarized. Wastes arising from reactor operation are described briefly. (auth)

1407 (CONF-750401-4) CORROSION MONITORING OF STORAGE BINS FOR RADIOACTIVE CALCINES. Hoffman, T. L. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs–Operations Office). Jan 1975. Contract AT(10-1)-1375. 17p. Dep. NTIS $4.00.

From NACE international corrosion/75 conference; Toronto, Canada (14 Apr 1975).

Highly radioactive liquid waste produced at the Idaho Chemical Processing Plant is calcined to a granular solid for long term storage in stainless steel bins. Corrosion evaluation of coupons withdrawn from these bins indicates excellent performance for the materials of construction of the bins. At exposure periods of up to six years the average penetration rates are 0.01 and 0.05 mils per year for Types 304 and 405 stainless steels, respectively. (auth)

1408 (DP-MS-75-25) MIGRATION OF TRITIUM FROM A NUCLEAR WASTE BURIAL SITE. Hawkins, R. H. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Sep 1975. Contract AT(07-2)-1. 15p. (CONF-750967-2). Dep. NTIS $4.00.

From 3rd ERDA environmental protection conference; Chicago, Illinois, USA (23 Sep 1975).

The Savannah River Plant (SRP) has routinely and continuously monitored the local environment (land, water, air, flora, and fauna) since 1951. As part of this intensive program, a three-part study was made to assess the tritium migration from an onsite burial ground for solid nuclear wastes and the resulting dose-to-man. A major source of tritium is buried, massive, Li-Al residues (referred to as melts) from the thermal extraction step in the SRP tritium production process. A melt with its extraction crucible and lid were immersed in water to measure the amounts of tritium released as HTO and HT to the water and to air. The result was a rapid release of 23 curies, of which approximately 99 percent was HTO that remained in the immersion water, and 1 percent was HT that passed into the air. (auth)

1409 (GSF-T-46, pp 47-61) DEPOSITING RADIOACTIVE WASTES IN THE SALT MINE ASSE. An Active Measure of Environmental Protection. Duerr, K.; Kuehn, K. 1973. (In German).

From environmental protection and mining; Clausthal-Zellerfeld, F. R. Germany (10 May 1973).

In environmental protection and mining.

The deposition of radioactive waste products in suitable rock salt formations at the moment presents the optimum solution to deal with the waste problem. Using the outlined measures, the safety of the population and their environment will be endangered in no way. The former salt mine Asse as final deposit for radioactive wastes thus fulfills an important task for the concerted environment protection. (GE)

1410 (INIS-mf-1703, pp 332-342) UNDERGROUND DISPOSAL OF RADIOACTIVE WASTES OF NUCLEAR POWER PLANTS ON THE TERRITORY OF THE EUROPEAN PART OF THE USSR. Tarasova, N. V. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

Methods of burying radioactive wastes in the Soviet Union, USA, France, Eastern Germany and a number of other countries are considered. A presentation is given of the characteristics of the main methods of waste disposal in the ground. Criteria are presented for waste disposal in deep, water-bearing strata. A description is given of the hydrogeological conditions for underground disposal of liquid radioactive wastes in the European part of the USSR. Problems of hydrogeological studies are discussed in determining the possibility for underground disposal of wastes from nuclear power plants. The suitability of underground disposal of wastes from nuclear power plants in deep, water-bearing strata is evaluated from the point of view of protecting natural resources and of economic effectiveness. (tr-auth)

1411 (ORNL-5060) MODELS FOR CALCULATING THE EFFECTS OF ISOTOPIC EXCHANGE, RADIOACTIVE DECAY, AND OF RECYCLE IN REMOVING IODINE FROM GAS AND LIQUID STREAMS. Davis, W. Jr. (Oak Ridge National Lab., Tenn. (USA)). Sep 1975. Contract W-7405-eng-26. 38p. Dep. NTIS $4.00.

Different decontamination factors for ^{129}I and ^{131}I are frequently invoked in environmental impact reports concerned with nuclear fuel recycle. Selected differences, or ratios, have not been justified on the basis of mathematical models or experimental data. A description is given of the origins of these differences in terms of isotopic exchange and material balance equations for the short- and long-lived (or stable) isotopes. The ratios of decontamination factors can be calculated when there is complete attainment of isotopic exchange between gas- or liquid-phase iodine and iodine sorbed by a solid or liquid. If there is no exchange, decontamination factors are isotope-independent unless material recycle occurs within the system. Between these extremes, there can be decontamination factors whose explanation requires experimental determination of the extent of exchange. The model applies to other radioactive isotopes of iodine as well as to other elements with short- and long-lived (or stable) isotopes. (auth)

1412 (SAND-75-0410) THERMAL RESPONSE OF BURIED RADIOACTIVE WASTE: CONDUCTION SOLUTIONS. Larson, D. W.; Gartling, D. K.; Hardee, H. C. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1975. Contract AT(29-1)-789. 53p. Dep. NTIS $5.45.

Three different solution methods are developed to determine the temperature field within and surrounding buried radioactive waste in high L/D configurations. The solution methods allow for one-dimensional radial conduction heat transfer only. The solutions are useful for sizing calculations. The results of the three methods compare very favorably. Specific examples are included. (auth)

1413 (TID-26873) ENVIRONMENTAL HAZARDS IN HIGH-LEVEL RADIOACTIVE WASTE DISPOSAL. Cohen, B. L. (Oak Ridge Associated Universities, Inc., Tenn. (USA)). Mar 1975. 18p. Dep. NTIS $4.00.

Numerical estimates of the long-term hazard from disposal of radioactive wastes from nuclear power plants are developed. (LK)

1414 RADIO-ACTIVE WASTE. Colomb, A. Rev. Polytech.; No. 1329, 1091-1097, 1137(25 Sep 1974). (In French).

Following a review of the sources of radioactive waste, and the emission and dosage criteria, the special problems arising with waste from nuclear power stations are discussed. The present methods of disposal, including deep-ocean dumping, and transport, are briefly described, and finally some estimate of the safety of present systems is given. (INIS)

1415 MANAGEMENT OF RADIOACTIVE WASTES. Lennemann, W. L.; Parker, H. E.; West, P. J. Int. At. Energy Agency Bull.; 17: No. 4, 2-13(Aug 1975).

Nuclear fuel cycle, mill tailings, fuel storage, decommissioning, ^{85}Kr and ^{3}H, storage and disposal of high-level and alpha-bearing wastes, and regional fuel reprocessing and waste management centers are considered in this discussion on management of radioactive wastes. (LK)

Handling Equipment and Procedures

Refer also to abstract 171.

1416 (CONF-751101-28) A 218 NEUTRON GROUP MASTER CROSS SECTION LIBRARY FOR CRITICALITY SAFETY STUDIES. Ford, W. E. III; Westfall, R. M.; Webster, C. C. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Computer Sciences Div.). 1975. 5p. Dep. NTIS $4.50.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

The AMPX system was used to generate a P_3 218 neutron group master cross-section library from ENDF/B-IV data for the fuel, structural, and neutron-absorbing materials tabulated. The library is the data base for the generation of broad-group cross sections for shipping cask calculations and other criticality safety analyses using codes such as KENO and ANISN. Selection of the fine-group energy structure for the 3-eV to 20-MeV energy range included consideration of the resonance structure of prominent nuclei, the thresholds of important reactions, and the fission spectra. For 10^{-5} less than or equal to E/sub n/ less than 3 eV, 78 closely spaced thermal groups were chosen to examine the effects of low-energy resonances and thermal-neutron upscatter. Distribution of the 218 groups within the Hansen-Roach 16-group boundaries is shown. Adequacy of the group structure and validity of selected data sets from the library were tested by P_3S_8 XSDRNPM calculations of k-eff for two benchmark critical experiments; first, the 4.9 percent-enriched UO_2F_2-H_2O solution critical sphere experiment of Johnson and Cronin was analyzed, and, second, the 93.2 percent-enriched UO_2F_2-H_2O solution critical sphere experiment of Fox was analyzed. (auth)

1417 (DUN-7824) FUEL STORAGE BASIN CRITICALITY SAFETY ANALYSIS REPORT AND TECHNICAL BASIS. Toffer, H. (Douglas United Nuclear, Inc., Richland, Wash. (USA)). Dec 1971. 76p. Dep. NTIS $6.00.

The criticality safety analysis was performed to provide a detailed answer to an AEC-RL inquiry about the feasibility of storing a full N Reactor fuel discharge in the storage basin with fully-loaded cubicles. This would require storage on top of the existing concrete cubicles which was not considered in the previous N fuel basis criticality analyses. No experimental criticality data exist for this particular configuration, so criticality control requirements were established by several independent computational methods. In addition, the storage system studied was too complex to evaluate against current N Reactor criticality criteria; therefore, a set of criteria based on the effective neutron multiplication factor, k/sub eff/, was formulated. The report describes the results of the criticality calculations, related hazards analyses, and provides a technical basis for specifying safe limits for storage of fuel on top of the cubicles in the fuel basin. The discussion includes seismic analysis and a description of modifications to structures which would provide adequate criticality control for the proposed storage method and increase utilization of available storage space. An engineering study is required to finally establish economic feasibility of the proposed storage configuration. (auth)

1418 GLOVE BOX CHAMBER. Cox, M. E.; Cox, M. E. US Patent 3,907,389. 23 Sep 1975. Filed date 12 Dec 1973. 10p.

An environmental chamber is described which enables an operator's hands to have direct access within the chamber without compromising a special atmosphere within such chamber. A pair of sleeves of a flexible material are sealed to the chamber around associated access apertures and project outwardly from such chamber. Each aperture is closed by a door which is openable from within the sleeve associated therewith so that upon an operator inserting his hand and arm through the sleeve, the operator can open the door to have access to the interior of the chamber. A container which is selectively separable from the remainder of the chamber is also provided to allow objects to be transferred from the chamber without such objects having to pass through the ambient atmosphere. An antechamber permitting objects to be passed directly into the chamber from the ambient atmosphere is included. (auth)

1419 REMOTE HANDLING SYSTEMS: HANDS AND EYES FOR NUCLEAR WORK. Ramaswamy, N. V. (Bhabha Atomic Research Centre, Bombay). Nucl. India; 13: No. 8/9, 5-10 (1975).

The design, production, operation, performance, and use of remote handling systems developed at the Bhabha Atomic Research Center, Trombay, India are described. (LCL)

Transportation

1420 (BNWL-1846) ASSESSMENT OF THE RISK OF TRANSPORTING PLUTONIUM OXIDE AND LIQUID PLUTONIUM NITRATE BY TRUCK. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1975. Contract E(45-1)-1830. vp. Dep. NTIS $7.60.

A methodology for assessing the risk in transporting radioactive materials and the results of the initial application of the methodology to shipment of plutonium by truck are presented. (LK)

1421 (BNWL-B-421) ASSESSMENT OF THE ENVIRONMENTAL IMPACT OF THE FAA PROPOSED RULE MAKING AFFECTING THE CONDITIONS OF TRANSPORT OF RADIOACTIVE MATERIALS ON AIRCRAFT. Hall, R. J.; Hendrickson, P. L.; King, J. C.; McSweeney, T. I.; Shipler, D. B.; Brown, C. L.; Davis, D. K.; Watson, E. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 10 Sep 1975. Contract E(45-1)-1830. vp. Dep. NTIS $7.60.

Amendments to Federal Aviation Administration (FAA) regulations relating to the transporting of radioactive materials on commercial aircraft are presented. Potential effects of the proposed changes are examined in the environmental impact statement, which is presented in the 10 sections and 5 appendices of this document. (JGB)

1422 (CONF-750846-1) IMPACT OF NUCLEAR FUEL CYCLE CENTERS ON SHIPPING SPECIAL NUCLEAR MATERIALS AND WASTES. Blomeke, J. O. (Oak Ridge National Lab., Tenn. (USA)). 1975. 24p. Dep. NTIS $4.25.

From engineering foundation conference on civil and engineering aspects of energy complexes; Henniker, New Hampshire, USA (5 Aug 1975).

The impact of integrated nuclear fuel cycle facilities on the transportation sector appears from this admittedly rather narrow study to be of only marginal significance. However, there are other factors which must be taken into account such as nuclear safeguards, economics, and radiological, ecological, institutional, and sociological impacts. Unless more clear-cut advantages can be shown by on-going studies for some of these other considerations, the regimentation and control of industry that would result from the imposition of the integrated fuel cycle facility concept probably could not be justified. (auth)

1423 CONTAINERS FOR THE TRANSPORT OF RADIOACTIVE MATERIALS. Bochard, C. (to Robatel, S. L. P. I.). US Patent 3,902,548. 2 Sep 1975. Priority date 28 Dec 1972, France. 4p.

The container for heat evolving radioactive materials has a metallic outer casing formed with outwardly projecting heat dissipating or cooling members, such as pins or fins, while each of its ends is formed with a flat flange which extends radially beyond the outer ends of the cooling members. A perforated wall extends between the flanges to define with same and with the periphery of the outer casing an annular space within which the cooling members are enclosed. This perforated wall is adapted to support a flexible covering sleeve the ends of which are clamped by inflatable seals between the periphery of the flanges and outer rings removably

secured to the latter. Spraying means are provided within the aforesaid space to permit of projecting an uncontaminated liquid on the cooling members to cool the container before and/or while the latter is immersed in a loading and unloading pond with the sleeve mounted in position. The lower flange is provided with liquid collecting and evacuating means and compressed air may be injected into the said space to force the collected liquid outwardly. (auth)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstracts 428, 1465, 1468, and 2060.

1424 (CONF-750564-1) PRODUCTION OF MEDICAL RADIOISOTOPES IN ORNL 86-INCH CYCLOTRON. Skidmore, M. R. (Oak Ridge National Lab., Tenn. (USA)). 1975. 8p. Dep. NTIS $4.00.

From iodine-123 planning conference; Rockville, Maryland, USA (19 May 1975).

Procedures, targets, and costs are discussed for the production of iodine-123 at the ORNL 86-Inch Cyclotron. The cyclotron is a fixed frequency machine producing 22-MeV proton beams with currents of 3 mA. Flat plate targets are used in the bombardment of readily fabricated metals when highest production rates are necessary, while capsule targets are used when flat plate coatings are difficult or when high production rates are not required. Window targets with metal foils or powders, inorganic compounds, or isotopically enriched materials are also used. (PMA)

1425 (DEU-75-9) SCIENTIFIC ANNUAL REPORT 1973. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). [nd]. 129p. (In German). INIS.

A report is given on the scientific research at DESY in 1973, which included the first storage of electrons in the double storage ring DORIS. Also mentioned are the two large spectrometers PLUTO and DASP and experiments relating to elementary particles and synchrotron radiation. Equipment improvements are described. (GE)

1426 (DEU-75-10) SCIENTIFIC ANNUAL REPORT 1972. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). [nd]. 137p. (In German). INIS.

Scientific research at DESY during 1972 is reported, including activities in the field of electron-nucleon scattering and photoproduction and synchrotron radiation. The work on the double storage ring, as well as on the extension to the synchrotron, are discussed. (GE)

1427 (INIS-mf-1698, pp 190-196) U-240 ISOCHRONOUS CYCLOTRON AS THE NEUTRON PULSED SOURCE. Bazavov, D. A.; Belyakov, V. A.; Bogdanov, P. V. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A description of construction additions to the isochronous cyclotron under construction in Kiev in order to convert it to the mode of a pulsed neutron source with a pulse duration of 1 nsec. These additions are deflector plates having a pulse duration of 1 nsec. These additions are deflector plates having a pulse feed system. (tr-SJR)

1428 (JINR-P9-9066) "SUPERCYCLOTRON" AS A TREND OF FURTHER DEVELOPMENT OF HIGH-CURRENT ACCELERATORS-MESON FACTORIES. Dzhelepov, V. P.; Dmitrievskii, V. P.; Kol'ga, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 22p. (In Russian). Dep. NTIS (US Sales Only) $5.00.

Results are presented of perspective research on meson factories which obtain superhigh-current (100mA) continuous beams. The ring cyclotron with strong focusing - a supercyclotron - was found to be a likely candidate. Linear accelerators were also considered. (auth)

1429 (JINR-P9-9067) DYNAMIC CHARACTERISTICS OF THE BOOSTER OF THE 70-GeV PROTON SYNCHROTRON. Dmitrievskii, V. P.; Kol'ga, V. V.; Polumordvinova, N. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 29p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The results of numerical calculations of the fundamental parameters of the 1.5-GeV booster synchrotron of IHEP are presented. The parameters calculated determine the particle motion dynamics. The effect of the booster parameter statistical variations on the orbit characteristics of the accelerated protons is considered. (auth)

1430 (JINR-P9-9115) INCREASING THE INTENSITY OF THE PROTON BEAM ACCELERATED IN THE JINR SYNCHROPHASOTRON. Beznogikh, Yu. D.; Bonch-Osmolovskii, A. G.; Voevodin, M. A.; Zinov'ev, L. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1975. 26p. Dep. NTIS (US Sales Only) $5.00.

The intensity of the proton beam accelerated in the JINR synchrophasotron was increased to 1.5×10^{12} p/p. The results of experimental investigations are presented, and ideas about dynamic Coulomb shifts are developed. (auth)

1431 (LBL-3835) ACCELERATOR DIVISION ANNUAL REPORTS, 1 JULY 1972-31 DECEMBER 1974. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 1974. Contract W-7405-eng-48. 32p. Dep. NTIS $4.00.

Research and development progress are reported on: (1) the Bevatron; (2) the Bevalac (heavy ion injection from the SuperHILAC into the Bevatron); (3) PEP (Positron-Electron Project) storage rings; (4) electron rings for collective effects research; (5) ESCAR (Experimental Superconducting Accelerating Ring with superconducting proton synchrotron); (6) the superconductivity program; and (7) hard rock tunneling using electron beams from a linear accelerator. A separate abstract was prepared for each of the three major sections of the report. (PMA)

For abstracts of individual sections see: 1432-1434.

1432 (LBL-3835, pp 1-8) BEVATRON/BEVALAC. 1974.

In accelerator division annual reports, 1 July 1972-31 December 1974. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The operations and programs of the Bevatron/Bevalac facility are discussed. The Bevalac, a linking of the SuperHILAC to the Bevatron, was completed and was commissioned in August, 1974. Machine and facility improvements are described including: (1) the kaon beam facility; (2) the Bevatron Injector II; (3) cryopumping for the Bevatron vacuum tank; (4) beam extraction systems for heavy ions; (5) the Bevalac beam transport system; (6) polarized proton and deuteron beam feasibility studies; (7) the LBL-UCLA streamer chamber facility (target chamber); (8) improvements in the operational systems; (9) the testing of superconducting magnets on the Bevatron beam lines; (10) a digital control master oscillator for tracking the Bevatron rf; (11) high-voltage clearing electrodes installed in the Bevatron gap; (12) photomultiplier feedback resonant beam extraction; and (13) a multiwire-chamber monitoring system for the Bevatron/Bevalac. (PMA)

1433 (LBL-3835, pp 9-28) ADVANCED ACCELERATOR RESEARCH AND DEVELOPMENT. 1974.

In accelerator division annual reports, 1 July 1972-31 December 1974. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Research and development on the Positron-Electron Project (PEP), the electron rings, the superconducting accelerator (ESCAR), and the superconductivity program are reported. Efforts relating to the proposed PEP include work on: (1) the injection system; (2) the rf system; (3) the main-ring bend magnets; (4) the magnet power supplies and controls; (5) alignment; (6) radiation and shielding; (7) the vacuum system; and (8) conventional facilities (utilities, etc.). Experimental and theoretical work continued on the development of suitably intense electron rings as vehicles for the collective acceleration of ions. The most difficult problem was found to be the longitudinal (negative mass) instability. Design work was begun for ESCAR (Experimental Superconducting Accelerating Ring), a small proton synchrotron and storage ring using superconducting magnets, which should aid in the design of future large superconducting facilities. Magnet development was largely directed toward the detailed design of the dipole units. A superconducting beam transport line was installed at the Bevatron. (PMA)

1434 (LBL-3835, pp 29-32) HARD ROCK TUNNELING USING PULSED ELECTRON BEAMS. Avery, R. T. Univ. of California, Berkeley; Brekke, T. L.; Finnie, I. 1974.

In accelerator division annual reports, 1 July 1972-31 December 1974. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Intense submicrosecond bursts of energetic electrons cause significant pulverization and surface spalling of a variety of rock types, the spall debris generally consisting of sand, dust, and small flakes. If carried out at rapid repetition rate this can lead to a promising technique for increasing the speed and reducing the cost of underground excavation of tunnels, mines, and storage spaces. The conceptual design features of a Pulsed Electron Tunnel Excavator capable of tunneling approximately ten times faster than conventional drill/blast methods were studied. (auth)

1435 (TRI-PP-75-7) STATUS OF TRIUMF. Richardson, J. R. (British Columbia Univ., Vancouver (Canada). TRIUMF

Facility). Aug 1975. 8p. (CONF-750824–11). Dep. NTIS (US Sales Only) $4.00.

From 7th international conference on cyclotrons and their applications; Zurich, Switzerland (19 Aug 1975).

Starting late in 1974, many of the capabilities of TRIUMF were explored. Beams of energies varying between 180 and 520 MeV were extracted down beam line IV. Simultaneous beams of differing energies were extracted down beam lines I and IV, and the ratios between the intensities of the two beams have been varied in a controlled manner. Beam currents so far were restricted to less than 300 nA in order to minimize induced activity, but a test run was made at 48 μA current in a pulsed mode. The normal macroscopic duty factor is 100%; the microscopic duty factor is 12%–5 ns pulses every 43 ns. By April, two physics experiments were underway simultaneously on two beams separately extracted from the cyclotron. (auth)

1436 (TRI-PP-75-8) PROPERTIES OF THE TRIUMF CYCLOTRON BEAM. Craddock, M. K.; Blackmore, E. W.; Dutto, G.; Kost, C. J.; Mackenzie, G. H.; Richardson, J. R.; Root, L. W.; Schmore, P. (British Columbia Univ., Vancouver (Canada). Dept. of Physics; British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Aug 1975. 4p. (CONF-750824–12). Dep. NTIS (US Sales Only) $4.00.

From 7th international conference on cyclotrons and their applications; Zurich, Switzerland (19 Aug 1975).

Eight % of the 300 keV dc beam from the ion source can be transmitted to 500 MeV in the TRIUMF cyclotron without using the buncher. The beam losses are entirely accounted for by the 40° phase acceptance at injection, 20% gas stripping and 6% Lorentz stripping; there are no significant losses due to orbit dynamic problems during 1500 turns of acceleration. The phase history, like ν_z^2, is in good agreement with predictions based on the magnetic field survey. The effect of the harmonic coils and injection parameters on beam quality was investigated; they can be used, with a chopper, to reduce the energy resolution of the extracted beam to 0.9 MeV FWHM and the emittance for 90% of the beam to 4π mm.mrad horizontally and 11π mm.mrad vertically. (auth)

1437 (UCRL-76953) COLLECTIVE-FIELD ACCELERATION OF HIGH-ENERGY IONS. Luce, J. S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Jul 1975. 11p. (CONF-741178-1). Dep. NTIS $4.00.

From conference on energy storage, compression and switching; Torino, Italy (5 Nov 1974).

A collective-field accelerator, evolving from experimental and theoretical research, uses a high-vacuum diode with an adjustable graphite cathode, as well as an insulated anode, and operates with a relativistic electron beam with nu/gamma of approximately 1. Alternate gradient lenses are used to focus collectively accelerated particles. The gradients are produced by alternate dielectric and grounded lenses. The dielectric lenses are self charged by the electron beam, creating a potential difference in reference to the grounded lenses. These lenses focus both electrons and ions by convective processes. Deuterons were accelerated in pulses of approximately 10^{14}, producing up to 10^{11} D-D neutrons per burst by impingement on suitable targets. Hydrogen, deuterium, carbon, fluorine, and chlorine ions were accelerated to produce both light- and heavy-ion reactions. Analysis of activation data shows that heavy ions with greater than 6 MeV per nucleon and protons with approximately 15 MeV energy were produced. Theoretical analysis indicates that the collective ion acceleration mechanisms arise from interactions with plasma-wave trains which are created by near-resonant, beam-cavity interactions and which are accelerated (in group velocity) through density and temperature gradients in the secondary plasma beyond the anode. (auth)

1438 THE FUTURE PROBLEMS OF THE SIN. Blaser, J. P. (Schweizerisches Inst. fuer Nuklearforschung, Villigen). Neue Tech.; 16: No. 10, 404-406(Oct 1974). (In German).

A progress report is presented on the Institute programs up to the beginning of 1974. The injector and accelerator were designed to accelerate protons to 590 MeV and have produced meson beams on the order of tens of μA. The principle difficulties are residual instabilities leading to accumulation of radioactivity. Equipment for research on muons comprising a super-conducting solenoid 10m long, a pion spectrometer, and the production of polarised protons and pulsed muon beams are discussed. It is hoped that work will soon begin on the biological effects of pion beams, including their use in the treatment of cancer. (INIS)

1439 BEVALAC: STATUS OF THE MACHINE AND OF THE PHYSICS RESEARCH PROGRAM. Hyde, E. K. (Univ. of California, Berkeley). Phys. Scr.; 10A: 30-35(1974).

The Bevalac is briefly described and its schedule for completion is given. The Physics Research Program to be carried out with heavy ion beams with energy in the range 0.250 to 2.1 GeV/nucleon is described. (auth)

1440 ELECTROSTATIC GENERATOR. Allen, W. D.; Morris, M. (to United Kingdom Atomic Energy Authority). US Patent 3,889,138. 10 Jun 1975. Priority date 28 Oct 1971, United Kingdom of Great Britain and Northern Ireland. 4p.

An electrostatic generator comprises a pair of side by side disposed endless chains, each chain comprising metal pellets insulated from one another, with metal strips interconnecting the pellets of one chain with oppositely-disposed pellets of the other chain. Induction electrodes are provided for charging the pellets and strips as the chains are made to rotate together, and for transferring the charges to a high voltage terminal. (auth)

1441 SMALL SCIENCE KEEPS A TOE-HOLD ON THE GIANT. Tanner, N. (Oxford Univ.). New Sci.; 67: No. 962, 372-373(14 Aug 1975).

Interest in low energy nuclear physics was revived at CERN, and the first accelerator built at the laboratory, the 600-MeV synchrocyclotron, was reopened. The synchrocyclotron will join the growing list of meson factories and will develop its own speciality, i.e., studies of highly unstable nuclear isotopes. (auth)

1442 NPL ELECTRON LINEAR ACCELERATOR. Teddington, Eng.; National Physical Lab. (1975). 8p.

A brief description of the new linear accelerator at the National Physical Laboratory is given. (UK)

1443 ACCELERATION OF POLARIZED PROTONS TO 8.5 GeV/c. Khoe, T. (Argonne National Lab., IL); Kustom, R. L.; Martin, R. L. Part. Accel.; 6: No. 4, 213-236(1975).

Polarized protons were accelerated to 8.5 GeV/c in the Zero Gradient Synchrotron (ZGS) at the Argonne National Laboratory and were successfully extracted and used for high energy physics experiments. The protons were initially polarized in a ground state atomic beam source at 20 keV, and then accelerated to 750 keV in a Cockcroft-Walton, and then to 50 MeV in a linac before injection into the ZGS. Pulsed quadrupoles in the ZGS were used to pass through several depolarizing resonances without significant depolarization. The protons were extracted either with an energy loss target or by resonance extraction. To date, 2×10^9 protons were accelerated to 6.0 GeV/c with 73 ± 8% polarization and to 8.5 GeV/c with 55 ± 15% polarization. (auth)

1444 NUMERICAL STUDIES OF ION-LOADED ELECTRON RINGS. Poukey, J. W. (Sandia Labs., Albuquerque, NM); Freeman, J. R.; Reiser, M. Part. Accel.; 6: No. 4, 245-250(1975).

A 2½-dimensional particle simulation code is used to study a ring of relativistic (3.5 MeV) electrons which is circulating in an applied uniform magnetic field. The ring is seeded with a small percentage of positive ions. Axial symmetry is assumed, and the transverse focusing conditions are investigated as a function of ring geometry, fraction of ions, and conducting boundaries. The mean radii of the electron and ion sub-rings are oscillating, and electron loss occurs under some conditions. Two methods which are effective in combating this loss are discussed: the inclusion of an inner conductor, and the elimination of magnetic images. (auth)

1445 LINEAR ACCELERATOR WITH X-RAY ABSORBING INSULATORS. Rose, P. H. (to Extrion Corp.). US Patent 3,903,424. 2 Sep 1975. Filed date 19 Feb 1974. 4p.

Annular insulators for supporting successive annular electrodes in a linear accelerator have embedded x-ray absorbing shield structures extending around the accelerating path. The shield members are disposed to intercept x-ray radiation without disrupting the insulative effect of the insulator members. In preferred forms, the structure comprises a plurality of annular members of heavy metal disposed in an x-ray blocking array, spaced from each other by the insulating substance of the insulator member. (auth)

Auxiliaries and Components

Refer also to abstracts 532, 817, and 1431–1433.

1446 (AD/A-004599) SOVIET RESEARCH AND DEVELOPMENT OF HIGH-POWER GAP SWITCHES. Kassler, S.; Hendricks, C. D. (Rand Corp., Santa Monica, Calif. (USA)). Jan 1974. Contract DAHC15-73-C-0181. 42p. (R–1333-ARPA). NTIS $3.75.

Progress is reported on a triggered pressurized gap switch, considered to be the most critical element of high-current electron-accelerator design. The work is the part of a continuing research and development study for high-current, relativistic, charged-particle beams. (GRA)

1447 (BNL-20356) ION DESORPTION CROSS SECTION OF CARBON CONTAINING MOLECULES ON ALUMINUM AND STAINLESS STEEL. Yu, M. L. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 12p. (CONF-750737-3). Dep. NTIS $4.00.

From proceedings of the ISABELLE summer study; Upton, New York, USA (14 Jul 1975).

It was proposed that the "pressure bump" phenomenon observed in the CERN ISR proton machine is caused by ion induced desorption of gas molecules from the vacuum chamber wall. Residual gas molecules ionized by the proton beam are accelerated by the beam to wall potential (order of kV), and bombard the chamber wall with near normal incidence sputtering off molecules. Mass spectrometric analysis of the residual gas content showed that gas molecules desorbed during the pressure bump are mostly carbon containing molecules, e.g., carbon monoxide and hydrocarbons. Such evidence seems to indicate that carbon containing contamination adsorbed on the vacuum chamber wall may be one of the major contributors to the pressure bump. Both stainless steel and aluminum were proposed or used as the vacuum wall material for the recent generation of accelerators. ISR at CERN uses stainless steel and aluminum is being proposed for ISABELLE at Brookhaven. The ion induced desorption rates of carbon containing molecules from the surfaces of these materials were determined and are compared. (auth)

1448 (CEAL-TM-198) DEMONSTRATION OF ADEQUACY OF CIRCUMFERENTIAL 4-INCH-THICK LEAD SHIELD TO PROTECT PERSONS CLOSE TO A 100-mA-AVG 3.5-GeV STORED ELECTRON BEAM EVEN IN THE EVENT OF A WORST-CASE BEAM DUMP. Maddox, B. J.; Winick, H. (Cambridge Electron Accelerator, Mass. (USA)). Jan 1973. 14p. Harvard Univ., Cambridge, MA.

Measurements at the Cambridge Electron Accelerator (CEA) show that a properly placed 4"-thick lead shield is adequate to protect personnel (working in close proximity to circulating beams) from the local dumping of 100 mA stored at 3.5 GeV. This shield may also be adequate to provide protection during brief, controlled injection periods. (auth)

1449 (JINR-P9-9119) INVESTIGATION OF THE IRON-CURRENT CHANNEL FOR THE PHASOTRON WITH SPATIAL MAGNETIC FIELD VARIATION. Vasilenko, A. T.; Zaplatin, N. L.; Lepilov, V. I.; Chesnov, A. F. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1975. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The construction of the iron-current section prototype is described. Calculated and experimental field characteristics are compared, and the forces resulting on the elements of the channel are calculated. (auth)

1450 (JINR-P9-9121) COMPUTATION RESULTS OF PULSES FORMED USING NONUNIFORM PULSE FORMER. Matora, I. M.; Savvin, V. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1975. 14p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

Results are given of computations voltage and current pulses formed using a non-uniform pulse former on the resistive load in the inductor section of linear induction accelerator loaded by accelerated electron current. An electron gun pulse transformer, loaded by beam currents and displacement currents was also investigated. The results agree satisfactorily with experiment for the resistive load and for the loads in which the parameters vary considerably during the pulse. (auth)

1451 (JINR-P9-9140) CALCULATION OF THE COMPRESSOR (3) MAGNETIC SYSTEM. Derendyaev, Yu. S.; Ivanov, I. N.; Kaminskaya, A. M.; Kaminskii, A. K.; Kuznetsov, A. B.; Pashevskii, V. P.; Sarantsev, V. P.; Svetov, L. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 23p. (In Russian). Dep. NTIS (US Sales Only) $5.00.

The magnetic system for the compressor (3) provides the electron ring compression and the magnetic field of strong homogeneity in the region of ring extraction (before accelerating system). The magnetic field is created by means of multiturn coils inside the compressor chamber, with the design taking into account the solenoid fields and the field screening by the chamber. Also taken into account is the effect of a continuous, perfectly conducting tube (with a radius less than that of the ring) on the field distribution in the region of extraction. (auth)

1452 (JINR-P9-9142) AUTOMATIC MEASUREMENT OF THE PHASE OF THE BEAM TRANSIT IN THE CYCLOTRON. Denisov, Yu. N.; Lyubenko, A. N.; Chihak, M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

Some problems concerned with phase measurements in the cyclotron were considered. Two methods used for the phase determination are described: over the intersection points and over the second harmonic. For a frequency of ~40MHz, the calculated accuracy for the phase determination was ~0.1°, and the mean square error of the most measurements was $\sigma \approx 2°$. (auth)

1453 (JINR-P9-9144) AUTOMATIC CONTROL OF THE BEAM TRANSIT PHASE IN THE ISOCHRONOUS CYCLOTRON. Anosov, V. N.; Denisov, Yu. N.; Kalmykov, A. V.; Lyubenko, A. N.; Novikov, D. L.; Chigak, M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 14p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

A digital system for control of the beam transit phase in the isochronous cyclotron is described. The phase value can be determined and sustained in time, with the deflection from the given value being not more than 2 to 3°. (auth)

1454 (TRI-PP-75-10) USE OF CAMAC WITH SMALL COMPUTERS IN THE TRIUMF CONTROL SYSTEM Gurd, D. P.; Heywood, D. R.; Johnson, R. R. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Aug 1975. 4p. (CONF-750824-8). Dep. NTIS (US Sales Only) $4.00

From 7th international conference on cyclotrons and their applications; Zurich, Switzerland (19 Aug 1975).

The TRIUMF control system uses several small computers rather than one larger one, providing a great deal of flexibility and allowing tasks to be partitioned in hardware rather than by a complex operating system. This flexibility was especially convenient during the developmental stages of TRIUMF. The multi-mini approach also improves mean time to repair by introducing at the computer level a modularity consistent with the CAMAC philosophy. All control system computers are to be interfaced simultaneously to a single CAMAC system of 35 crates on seven branches. Other computers, belonging to separate systems, communicate with the control system via parallel CAMAC-to-CAMAC links. Modularity at both the computer and controller levels, combined with CAMAC multisourcing, allowed the introduction of considerable redundancy, increasing overall system reliability. (auth)

1455 (TRI-PP-75-11) TRIUMF rf SYSTEM: INITIAL OPERATING PROBLEMS AND THEIR SOLUTIONS. Gummer, R. H. M.; Poirier, R. L.; Zach, M. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Aug 1975. 4p. (CONF-750824-10). Dep. NTIS (US Sales Only) $4.00.

From 7th international conference on cyclotrons and their applications; Zurich, Switzerland (19 Aug 1975).

The TRIUMF rf system was commissioned in December 1974, with the cyclotron coming into operation later the same month. Details of the rf system are summarized, and the performance of the rf system over the first eight months of operation is discussed. Some problems of resonator frequency drift as a function of temperature and cyclotron geometry were encountered. Rf leakage within the beam gap led to serious sparking and rf pick-up on the beam diagnostic probes. The solution of these and other problems affecting the rf system are discussed. (auth)

1456 NEW DEFLECTED-BEAM GAUGE FOR PRESSURES BELOW 10^{-12} TORR. Blechschmidt, D. (CERN, 1211 Geneva 23, Switzerland). J. Vac. Sci. Technol. 12: No. 5, 1072-1078 (Sept 1975).

Design and performance of a new hot-filament ionization gauge, specially developed for total pressure measurements down to 10^{-14} Torr, are described. The gauge features an electrostatically deflected ion beam which is directed at the funnel cathode of a small channel electron multiplier (CEM). The spurious signal due to electronic desorption of ions from the anode is extremely small, because these ions are typically of higher initial total energy than those from the residual gas, and may, therefore, be evicted from the high-energy side of the ion beam that is energetically dispersed by the deflecting electric field. The x-ray background corresponds to a pressure in the 10^{-14} Torr range, and since it can be measured just by inverting the deflector potential, it may easily be zeroed out electronically. Almost none of the secondary particles, released by x rays or ions from the deflecting electrodes, is counted, because the CEM cathode is operated at high negative potential and because most positive secondary ions are collected at the negative deflecting electrode, due to their small kinetic energy. The gauge's sensitivity for nitrogen is about 10^{17} counts/s·Torr·A, corresponding to 10^3/Torr for a CEM gain of 10^7. It is mounted on a 113.5-mm metal flange with ceramic feedthroughs and may be baked up to about 300°C. (auth)

1457 SUPERCONDUCTING CYCLOTRONS. Schneider, H. R.; Fraser, J. S.; Bigham, C. B. (Atomic Energy of Canada, Ltd., Chalk River). IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 443-446 (Mar 1975).

The use of high field superconducting dc magnets in cyclotron design makes possible accelerators that are small and consequently have a significant cost advantage over comparable iron-magnet cyclotrons. A general description of superconducting isochronous cyclotrons is given, with emphasis on the magnet

design requirements. Saturated iron poles to provide flutter focusing are described. A conceptual design for a heavy ion energy booster cyclotron for a tandem Van de Graaff is described. Similar cyclotrons for production of proton or deuteron primary beams and pi mesons or neutron secondary beams can, in view of the low cost, be considered for dedicated applications such as activation analysis or cancer therapy. (auth)

1458 AUTOMATIC MONITORING OF THE PARAMETERS OF THE HF SUPPLY SYSTEM OF A LINEAR ELECTRON ACCELERATOR. Grishaev, I. A.; Mufel, V. B.; Nikitina, T. F. (Physicotechnical Inst., Kharkov). Instrum. Exp. Tech.; 18: No. 1, 20-22(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 27-29(1975).

A circuit for the automatic monitoring of the parameters of the high-frequency supply system of a linear electron accelerator using signals from the output of the accelerating section is considered. A brief estimate of the information contained in the signals is given, and the results of measurements of certain parameters made using a Dnepr-2 computer are presented. Particular attention is given to monitoring the amplitude stability and to determining the relative value of the current load of the accelerating field in these sections. (auth)

1459 HIGH-VOLTAGE FLIP-FLOP FOR AN ELECTROSTATIC ACCELERATOR BEAM TRIP. Brovchenko, V. G.; Molchanov, Yu. D.; Ol'kin, V. A. (Inst. of Atomic Energy, Moscow). Instrum. Exp. Tech.; 18: No. 1, 119-121(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 108-110(1975).

This vacuum-tube high-voltage flip-flop produces square pulses on a capacitative load; it can produce amplitudes of 800 to 3000 V on 100 pF at repetition frequencies up to 300 kHz with rise times of about 100 nsec. The device is economical, and the power dissipated is governed by the pulse repetition frequency, being almost independent of the mach-to-space ratio at a given frequency. The maximum pulse length is restricted only by the service light of the circuit element. The mach-to-space ratio can be varied over a wide range. The device is used in an electrostatic accelerator beam trip. (auth)

1460 SHUNT IMPEDANCE OF SPIRAL LOADED RESONANT RF CAVITIES. Peebles, P. Z. Jr.; Parvarandeh, M. (Univ. of Tennessee, Knoxville). Part. Accel.; 6: No. 4, 201-209(1975).

Based upon a treatment of the spiral loaded resonant radio frequency cavity as a shorted quarter-wave transmission line, a model for shunt impedance is developed. The model is applicable to loosely wound spirals in large diameter containers. Theoretical shunt impedance is given for spirals wound from tubing of circular or rectangular cross section. The former produces higher shunt impedance. Measurements made on seventeen copper cavities are described which support the theoretical results, and theoretical results are also compared to data from twenty-three additional cavities. The theoretical function forms a useful means of interpreting the quality of constructed cavities. (auth)

1461 FILAMENT SUPPLY CIRCUIT FOR PARTICLE ACCELERATOR. Thompson, C. C. Jr.; Malone, H. F. (to Radiation Dynamics, Inc.). US Patent 3,908,160. 23 Sep 1975. Filed date 31 Jan 1974. 6p.

In a particle accelerator of the type employing ac primary power and a voltage multiplication apparatus to achieve the required high dc accelerating voltage, a filament supply circuit is powered by a portion of the ac primary power appearing at the last stage of the voltage multiplier. This ac power is applied across a voltage regulator circuit in the form of two zener diodes connected back to back. The threshold of the zeners is below the lowest peak-to-peak voltage of the ac voltage, so that the regulated voltage remains constant for all settings of the adjustable acceleration voltage. The regulated voltage is coupled through an adjustable resistor and an impedance-matching transformer to the accelerator filament. (auth)

1462 ELECTRON BEAM PRODUCING SYSTEM FOR VERY HIGH ACCELERATION VOLTAGES AND BEAM POWERS. Andelfinger, C.; Dommaschk, W.; Ott, W.; Ulrich, M.; Weber, G. (to Max-Planck-Gesellschaft zur Foerderung der Wissenschaften e.V.). US Patent 3,906,280. 16 Sep 1975. Priority date 22 Jun 1972, F.R. Germany. 8p.

An electron beam producing system for acceleration voltages on the order of megavolts and beam powers on the order of gigawatts is described. A tubular housing of insulating material is used, and adjacent to its one closed end, a field emission cathode with a large surface area is arranged, while at its other end, from which the electron beam emerges, an annular anode is arranged. The device for collimating the electron beam consists of annular electrodes. (auth)

1463 MULTIPERIODIC ACCELERATOR STRUCTURES FOR LINEAR PARTICLE ACCELERATORS. Tran, D. T. (to C.G.R.-Mev.). US Patent 3,906,300. 16 Sep 1975. Priority date 7 Jul 1972, France. 6p.

High efficiency linear accelerator structures, comprised of a succession of cylindrical resonant cavities for acceleration, are described. Coupling annular cavities are located at the periphery, each being coupled to two adjacent cylindrical cavities. (auth)

1464 DEVICE FOR IRRADIATION WITH ENERGY RICH ELECTRONS. Benedetti, R. G. (to Siemens Aktiengesellschaft). US Patent 3,903,421. 2 Sep 1975. Filed date 23 Jun 1974. 4p.

A device for irradiation with energized electrons wherein the electrons are guided upon a specific irradiation field by means of a magnetic field is described. The device is particularly characterized by the provision of a deflection device and a magnetic focussing device located one behind the other in the direction of the electronic ray at the outlet window of the source of electrons. (auth)

Ion Sources and Injection and Extraction Systems

1465 AD/A-004437) ADJUSTMENT AND OPERATION IN A PULSED MODE OF THE ELECTROSTATIC ACCELERATOR EG-1 OF THE PHYSICAL ENERGY INSTITUTE. Volodin, V. I.; Glotov, A. I. 20 Dec 1974. Translated from pp 113-114 of Trudy II Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits, Moskova, 11-18 November 1970, 1972. (FTD-HC-23-2819-74). 13p. NTIS $3.25.

The electrostatic accelerator EG-1 was converted into a pulsed system using a newly developed pulsed ion source. This modification will allow nuclear physics experiments using time of flight measurements for neutrons around the keV energy range. (GRA)

1466 (JINR-P13-8961) ION SOURCE WITH SURFACE IONIZATION FOR BEMS-2 MASS-SEPARATOR IN A HEAVY ION BEAM. Bogdanov, D. D.; Voborzhil, I.; Dem'yanov, A. V.; Karnaukhov, V. A.; Petrov, L. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

An ion source with surface ionization for a mass-separator in a heavy ion beam is described. The source was tested in the rare-earth element separation. The efficiency of the Dy extraction is equal to (20 ± 5)% at 2600°K. The hold-up time in the source for Dy and Rb was measured. (auth)

1467 "MIDI-CONSOLE": AN INTERACTIVE DISPLAY FOR PROCESS CONTROL. Daneels, A. (European Organization for Nuclear Research, Geneva (Switzerland)). Neue Tech.; 16: No. 10, 389-397(Oct 1974).

A cheap interactive console for computer assistance in the manual control of a process (the Synchrotron injector) has been developed at CERN. The main components are an alphanumerical display unit of 4 lines of 32 characters each, a push-button matrix for selecting control variables (maximum 256 per console), and a specialized control panel. Most of the efforts have been concentrated on designing a specialized software system, on the one hand to drive this equipment and on the other hand to perform the required control on the selected process variable. Three such consoles, called "midi-consoles", have been installed for the control of the CERN synchrotron injector. They allow three different human operators to work in parallel and to perform fast and simultaneous control, each on two control variables, which may be single control elements (e.g., a power supply) or control vectors (several elements whose control values are combined linearly). (auth)

1468 CHARACTERISTICS OF A HIGH FREQUENCY ION SOURCE USED IN A LOW-ENERGY ACCELERATOR. Abdelaziz, M. E. (Univ. of Tripoli, Libya); Eid, M. A.; Abdelsalam, F. Pramana; 4: No. 5, 229-241(May 1975).

Characteristics are presented for a high frequency ion source for a low energy, 150 keV accelerator to be used as a neutron generator. The accelerator design is based on a theoretical analysis which shows that if the axial potential in an electrostatic electrode system is made to increase with four thirds the power of axial distance, inward electric forces will compensate space charge forces tending to blow up the beam. As a result, a simplified acceleration tube, much shorter and of higher gradient than the conventional acceleration columns, may be used. The ion source itself is an ordinary type using axial extraction of the beam, and its main properties investigated are the beam current and beam quality (or emittance). Dependence of the two on different parameters is investigated in a series of tests. (auth)

1469 SYSTEM FOR TRANSPORTING THE BEAM IN THE CYCLOTRON AT THE ATOMIC ENERGY INSTITUTE. Venikov,

N. I.; Kondrat'ev, L. G.; Latushkin, S. T.; Maksimov, V. M.; Rezvov, V. A.; Son, V. G.; Unezhev, V. N.; Khaldin, N. N.; Chumakov, N. I.; Yudin, L. I. (Atomic Energy Inst., Moscow). Instrum. Exp. Tech.; 18: No. 1, 16-19(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 23-26(1975).

The system for transporting ions from the Atomic Energy Institute cyclotron was rebuilt to improve the beam parameters at the target. Two regimes are used: (1) dispersionless; and (2) with monochromatization to $\Delta E/E = 10^{-3}$. Convenient and reliable systems were developed for beam diagnostics. BeO scintillators are used, and two-coordinate scanning and current stabilization on the targets were realized. The horizontal emittance of the beam on the target was improved by approximately a factor of three. (auth)

Ion Optics and Field Calculations

Refer also to abstract 1482.

1470 (JINR-P11-8981) NUMERICAL SOLUTION OF THE MAXWELL EQUATION SYSTEM IN AN INHOMOGENEOUS REGION WITH MOVING DISCONTINUITY IN THE RIGHT-HAND PART. Bakhvalov, N. S.; Bondarenko, V. S.; Zhidkov, E. P.; Rubin, S. B.; Serdyukova, S. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1975. 15p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A numerical solution is given for a problem about the excitation of a closed inhomogeneous structure by a dense moving electron bunch. The corresponding group of the Maxwell equations is solved by the finite-difference method. The method is simple and economical on computer as compared to the known methods that use the Fourier-series expansion. The main difficulty is to overcome the instability phenomena. A rather stable method of counting was found in the process of numerical experiments, carried out on the basis of theoretical results. (auth)

1471 (LA-tr-75-28) MEASUREMENT OF THE EMITTANCE OF A BEAM BY 9040 COMPUTER. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1975. Translation of SEDAP-SEFS-TD-75-30. 52p. Dep. NTIS $5.50.

Two computer programs were developed to compute beam emittance at the Saturne Synchrotron: (1) EMIQ, using the three-slope method; and (2) EMIL, using the three-plane method. General considerations of the techniques and characteristics of each code are outlined. (PMA)

1472 (LA-tr-75-29) COMPARISON OF TWO METHODS FOR MEASURING THE EMITTANCE OF A BEAM. Parain, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1975. Translation of SOC-UTI-19. 20p. Dep. NTIS $4.50.

Two methods of measuring beam emittance were analyzed. The three-distance method is based on measurement of the dimensions of the beam at three points, while the three-slope method uses beam dimension measurements under three focusing conditions. Allowing for the errors in measuring the dimensions of the beam, the two methods are of equal accuracy. The three-distance method requires three detectors, but it has the advantage of making it possible to measure the emittance on a single cycle of the accelerator, and can therefore be used to perform control measurements on each cycle. (auth)

1473 TRANSVERSE DEFLECTION OF THE BEAM IN A LINEAR ACCELERATOR BY AN EXTERNAL OSCILLATOR. Kramskoi, G.D.; Shendrik, V.A. Sov. Phys.—Tech. Phys. 20: No. 1, 122-122 (July 1975).

The effect of pulse width and power level of a stationary oscillator at the frequency of the defocusing EH_{11} mode on the transverse beam instability is studied in a linear electron accelerator. The theory is compared with the experimental data. (auth)

1474 QUADRUPOLE—OCTUPOLE LENS SYSTEM WITH AN AXISYMMETRIC COMPONENT. Petrov, I.A.; Shpak, E.V. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad). Sov. Phys.—Tech. Phys. 20: No. 1, 125-127 (July 1975).

Systems consisting of two and three combined lenses are treated. It is shown experimentally that a doublet of combined lenses can create an image with magnifications that are equal in absolute value. The condition is obtained for which a triplet of combined lenses is an analog of an axisymmetric lens and creates a real image. (auth)

1475 LOSS IN NEGATIVE HYDROGEN-ION BEAMS IN MeV LINEAR ACCELERATORS. Gel'fand, E.K.; Lupandin, O.S.; Murin, B.P.; Sychev, B.S.; Fedotov, A.P. Sov. Phys.—Tech. Phys. 20: No. 1, 44-46 (July 1975).

A rate of induced radioactivity near the accelerator of about 2.8 mrad/h can be adopted as a measure of the permissible loss for a clean accelerator. The vacuum required to achieve the loss per unit length of accelerated H^- ions corresponding to this rate of induced radioactivity is evaluated in the beam channel of a linear accelerator. The loss of H^- ions due to dissociation in the magnetic fields of the doublets is also considered; it is a much smaller fraction of the total loss. (auth)

1476 ELECTRON BEAM TRANSPORT EXPERIMENTS WITH SHORT DURATION PULSES. Genuario, R. D. (Harry Diamond Labs., Adelphi, MD). IEEE (Inst. Electr. Electron. Eng.). Trans. Nucl. Sci.; NS-22: No. 5, 2098-2102(Oct 1975).

Experiments were designed to extend the simulation of IEMP effects by fast pulse (less than 5 ns) electron-beam techniques to larger areas (greater than 700 cm^2) and greater total currents (approximately 9 kA) than heretofore. Both charge and current neutralization as a function of pressure from less than 10^{-2} mTorr were determined with an electron-beam facility that generated an injected pulse with rise time approximately 1,5 ns and a peak intensity of 12,5 A/cm^2. The results indicate that for such large time rate of change of total currents, the necessary pressure to achieve space-charge barrier dissipation before the peak of the pulse will also lead to avalanche breakdown of the ambient gas, occurring at almost the same time and thus reducing the net transmitted current. (auth)

1477 ENVELOPE EQUATION IN THE DISPERSIVE PLANE OF A BENDING MAGNET. Knowles, H. B. (Los Alamos Scientific Lab., NM). Part. Accel.; 6: No. 4, 193-200(1975).

A second-order differential equation for the beam envelope, originally designed to calculate envelope changes inside non-dispersive magnets, was adapted to permit calculation of the envelope of an off-central momentum beam in the dispersive plane inside any bending magnet. (auth)

1478 METHOD AND APPARATUS FOR POSITIONING A BEAM OF CHARGED PARTICLES. Michail, M. S.; Woodard, O. C.; Yourke, H. S. (to International Business Machines Corp.). US Patent 3,900,736. 19 Aug 1975. Filed date 28 Jan 1974. 20p.

A beam of charged particles is stepped from one predetermined position to another to form a desired pattern on a semiconductor wafer. There is a dynamic correction for the deviation of the actual position of the beam from its predetermined position, so that the beam is applied to the deviated position rather than the predetermined position. Through the location of four registration marks, the writing field is precisely defined. Writing fields may be interconnected by the sharing of registration marks, enabling the construction of chips which are larger than a single writing field. (auth)

Storage Rings

Refer also to abstracts 1425, 1426, 1431, and 1433.

1479 (BNL-20456) LARGE EQUIPMENT AND FACILITIES. Louttit, R.; Love, W.; Lindenbaum, S. J. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 25p. (CONF-750737-1). Dep. NTIS $4.25.

From proceedings of the ISABELLE summer study; Upton, New York, USA (14 Jul 1975).

Component and design criteria are reviewed for a general purpose modular multiparticle spectrometer system. The study of hadronic interactions is emphasized, although the solenoidal magnet vertex detector system can be used for W bosons and other weak interaction processes. A general purpose spectrometer seems compatible with the requirements of the ISABELLE straight sections. (auth)

1480 (BNL-20478) ISABELLE RING STRUCTURE AND PERFORMANCE. Month, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 8 Jul 1975. 29p. Dep. NTIS $5.00.

A summary of the ISABELLE Ring Structure is presented. A phased approach to ISA operation is detailed. The initial performance potential indicates that p-p collisions at a wide range of energies and unequal energies in the two beams will be possible. The quasi 8-fold periodicity could be broken to allow a hi-luminosity set-up, which could be achieved by small changes in the insertion quadrupole strengths. A discussion is given of future ISA phases requiring the alteration of the physical layout of the insertions for various special experimental conditions. (auth)

1481 (DESY-75/26) LONGITUDINAL INSTABILITIES OF A SINGLE BUNCH AND THE OBSERVATION OF REDUCED LANDAU DAMPING IN DORIS. Kohaupt, R. D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F.R. Germany)). Aug 1975. 16p. Dep. NTIS (US Sales Only) $4.00.

A single electron bunch current in DORIS was limited to 1.5 mA/bunch by longitudinal instabilities. The shift of the incoherent synchrotron frequency was measured by excitation of the quadrupole mode. For 1 mA/bunch at the natural beam dimensions, the incoherent shift was found to be sufficient to reduce Landau damping. The observed longitudinal instability of a single bunch turned out to be weak, restrained only by radiation damping. This weak instability was removed by Robinson damping, and 15 mA/bunch were reached. (auth)

1482 EXPERIMENTS ON ELECTRON COOLING. Budker, G. I.; Derbenev, Ya. S.; Dikanskii, N. S. (Inst. of Nuclear Physics, Novosibirsk, USSR). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2093-2097(Oct 1975).

Experiments on electron cooling were carried out on the antiproton storage ring, NAP-M, using 50 MeV proton beams, cooled with 27 keV electrons from a three electrode gun. The proton beam lifetime increased from 900 s to 5,000 s with electron cooling. Diagnostic methods are described, and some possible applications of electron cooling are discussed. (PMA)

Experimental Facilities

Refer also to abstracts 749 and 2206.

1483 (INIS-mf-1698, pp 197-202) NEUTRON SPECTROMETER BASED ON THE U-240 ISOCHRONOUS CYCLOTRON. Bazavov, D. A.; Bogdanov, P. V.; Isaev, A. G. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In Neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Additional external devices were manufactured, by means of which it was possible to use the isochronous cyclotron Y-240, being constructed at IYaI of the Ukrainian Academy of Sciences as a neutron spectrometer. These devices consist of three channels having different time-of-flight bases and detecting systems. A presentation is given of the types of measurements which can be carried out on this spectrometer. (tr-SJR)

1484 (INIS-mf-1698, pp 213-222) NEUTRON SPECTROMETERS BASED ON PROTON BEAMS OF A MESON FACTORY. Stavisskii, Yu. Ya. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The possible parameters of time-of-flight spectrometers for studies with slow resonances and fast neutrons on the basis of the grouped proton beams from a meson factory in the USSR are described. (tr-SJR)

1485 (JINR-P9-8798) PROJECTED CHANNELS OF NUCLEON BEAMS OF A PHASOTRON WITH MAGNETIC FIELD VARIATION. Demianov, A. V.; Dzhelepov, V. P.; Zamolodchikov, B. I.; Kropin, A. A.; Roganov, V. S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 28p. (In Russian). Dep. NTIS (US Sales Only) $4.75.

The projected channels of nucleon beams of a high-current phasotron with magnetic field variations are described. Unpolarized, transverse- and longitudinal-unpolarized beams of protons and neutrons, and neutron beams of high energy resolution are extracted through these channels into the experimentation areas. (auth)

1486 AUTOMATION OF EXPERIMENTS IN THE SYNCHROCYCLOTRON OF THE JOINT INSTITUTE FOR NUCLEAR RESEARCH BY MEANS OF THE NP-2116C ELECTRONIC COMPUTER. Medved, S. V.; Sinaev, A. N.; Khan, B.; Chistov, N. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech.; 18: No. 1, 79-81(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 75-77(1975).

An automated system for the storage and primary analysis of information obtained from experiments with the JINR synchrocyclotron is described. The sources of information include various devices of multichannel and multidimensional analysis, wire-type spark chambers, counting systems, etc. The information from these devices passes to one of six storage systems incorporating 4096 channels each. When the selected exposure has ended, the accumulated information is transmitted to a HP-2116C computer, in which the analysis takes place. After the initial specification of the corresponding conditions and working programs, the process may be enacted automatically without the intervention of the research worker. (auth)

1487 IMPROVEMENTS IN OR RELATING TO TARGET CHAMBERS. Ryding, G. (to Lintott Engineering Ltd.). British Patent 1,389,294/B/. 3 Apr 1975. Filed date 20 Apr 1972. 6p.

Specifications are given for an apparatus designed to move a target chamber relative to an ion beam for ion implantation work. A uniform distribution of ions over the target area is achieved by moving the targets along helical paths. The configuration of drive shafts, endless bands (belts or chains) and bearings is described. (UK)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

1488 (AD/A-004198) RESEARCH ON SOLAR PHYSICS, PULSARS, AND COSMOLOGY. Final Report, 1 July 1970–31 December 1974. Dicke, R. H. (Princeton Univ., N. J. (USA). Dept. of Physics). 31 Dec 1974. Contract N00014-67-A-0151-0027. 8p. NTIS $3.25.

The contract was concerned with solar physics problems involving the solar oblateness, the precision timing of optical pulses from the Crab nebula pulsar and the polarization and isotropy of the cosmic microwave background radiation. (GRA)

Cosmic Radiation

Refer also to abstracts 773, 777, and 1929.

1489 (AD/A-003727) SATELLITE TELESCOPE FOR PROTONS AND ALPHAS. Final Report, 17 November 1972–30 November 1974. Morel, P. R.; Hanser, F. A.; Sellers, B. (Panametrics, Inc., Waltham, Mass. (USA)). Nov 1974. Contract F19628-73-C-0213. 40p. NTIS $3.75.

A satellite-borne detector for protons and alpha particles has been developed and flown. The detector uses two totally depleted silicon surface barrier detectors in a coincidence telescope arrangement to detect 5-100 MeV protons and 22-100 MeV alpha particles. A calibration mode allows the front detector to be used to detect launched on board satellite OV5-6 in May 1969 and is still yielding reliable data more than 5 years later. (GRA)

1490 (KFKI-75-46) GALACTIC COSMIC RAY ANISOTROPY AT APPROX. 6.10^{13} eV. Gombosi, T.; Kota, J.; Somogyi, A. J.; Varga, A.; Betev, B.; Katsarski, L.; Kavlakov, S.; Khirov, I. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1975. 10p. (CONF-750805-8). Dep. NTIS (US Sales Only) $4.50.

From 14th international cosmic ray conference; Munich, F.R. Germany (15 Aug 1975).

Arrival times of 1.14×10^8 extensive air showers registered on the peak Musala (geographical latitude 42°N) have been analysed for sidereal variation. The solar and antisidereal waves remain below noise level whilst the first and second sidereal daily waves prove to be significant adding up to an anisotropy of 0.1 per cent. Intensity maximum is obtained when directions near the galactic plane are scanned. Some consequences of the result obtained are discussed. (auth)

1491 (KFKI-75-48) PROPAGATION OF 10^{11}-10^{14} eV PARTICLES IN THE GALAXY. Gombosi, T.; Kota, J. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1975. 11p. (CONF-750805-9). Dep. NTIS (US Sales Only) $4.50.

From 14th international cosmic ray conference; Munich, F.R. Germany (15 Aug 1975).

A "semi-compound" diffusion model is suggested which combines the random separation of galactic magnetic field lines with compound diffusion. The diffusion's being one-dimensional is restricted to regions in which the field lines being initially gyroradius apart remain well-correlated. Assuming particle escape at the edges of the galactic disc the mean confinement time is given. Also discussed are the direction and magnitude of the anisotropy as well as its angular structure. (auth)

1492 CHARGE RATIO OF ULTRA-HIGH-ENERGY COSMIC-RAY MUONS. Ashley II, G.K.; Keuffel, J.W.; Larson, M.O. (Physics Department, University of Utah, Salt Lake City, Utah 84112). Phys. Rev. D 12: No. 1, 20-35 (1 July 1975).

We describe the data analysis and report the results of the final charge-ratio experiment using the Utah cosmic-ray muon detector. Values for the charge ratio were obtained from least-squares fits to the observed bending-angle distributions. The fitting function was the result of folding the noise scattering distribution into the ideal local-spectrum bending distribution, with the charge ratio as a parameter of the fit. This method permitted a greater precision while circumventing the main causes of charge-ratio dilution. We obtain the average value 1.378 ± 0.015 for muon momentum at production between 1 and 8 TeV/c, corresponding to a median primary cosmic-ray momentum range 8-61 TeV/c. With the results of this experiment the charge ratio is precisely known over about three decades of muon energy beginning around 10 GeV. Thus, we believe the charge ratio can serve as a touchstone in determining the hadronic interaction dynamics and composition of the primary cosmic rays. Already approximate agreement has been obtained with experimental results from predictions utilizing the scaling-limiting-fragmentation hypothesis and constant composition of the primary cosmic rays. (auth)

1493 EVIDENCE FOR DETECTION OF A MOVING MAGNETIC MONOPOLE. Price, P.B.; Shirk, E.K. (Physics Department, University of California, Berkeley, California 94720); Osborne, W.Z.; Pinsky, L.S. Phys. Rev. Lett. 35: No. 8, 487-490 (25 Aug 1975).

A very heavy particle passed through a balloon-borne stack of Cherenkov film, emulsion, and Lexan sheets. In 33 Lexan sheets it produced tracks expected of either a nucleus with $125 \lesssim Z \lesssim 137$ and $\beta \lesssim 0.92$ or a magnetic monopole with $g = 137e$. Its track structure in emulsion indicated it was moving downward with $\beta = 0.5_{-0.05}^{+0.1}$ and was either a nucleus with $Z \simeq 80$ or a monopole with $g = 137e$. These facts strongly favor identification of the particle as a magnetic monopole of strength $g = 137e$ and mass $> 200 m_p$. (auth)

1494 MUON CHARGE RATIO PREDICTION FROM HADRONIC SCALING. Hoffman, H.J. (Department of Physics, University of California, San Diego, La Jolla, California 92037). Phys. Rev. D 12: No. 1, 82-91 (1 July 1975).

In view of a number of contrasting results for the cosmic-ray muon ratio, a careful calculation is carried out and extended down to $E_\mu = 50$ GeV. It is found that even with the large uncertainties involved the calculated μ^+/μ^- ratio is significantly higher than the experimental values over the energy range considered. Nuclear corrections have only a small effect if a coherent production model is used and cannot remove the discrepancy, which we conclude requires some new features of high-energy interactions, a higher n/p ratio in the primary flux, or both. (auth)

1495 ISOTOPIC COMPOSITION OF COSMIC-RAY NITROGEN AT 1.5 GeV/amu. Dwyer, R.; Meyer, P. (Enrico Fermi Institute and Department of Physics, University of Chicago, Chicago, Illinois 60637). Phys. Rev. Lett. 35: No. 9, 601-604 (1 Sept 1975).

We have determined the cosmic-ray $^{15}N/(^{14}N+^{15}N)$ ratio with a detector sensitive to velocities of particles in the penumbra of Earth's magnetic field. Our instrument was flown twice on high-altitude balloons from Palestine, Texas, obtaining an exposure factor of 20 m^2 sr h. We measure the fraction of ^{15}N to be 0.45 ± 0.07 at 1.5 GeV/amu consistent with an origin for nitrogen primarily due to spallation in the interstellar medium. (auth)

1496 HIGH-ENERGY GAMMA-RAY ASTRONOMY. Fichtel, C. (Laboratory at Goddard Space Flight Center); Greisen, K.; Kniffen, D. Phys. Today 28: No. 9, 42-50 (Sept 1975).

A brief review is given of the emerging field of gamma-ray astronomy. Among the topics covered are gamma detection techniques, cosmic gamma sources, and advances in our knowledge of galactic history. (AIP)

1497 MEASUREMENT OF PRIMARY COSMIC-RAY ELECTRONS AND POSITRONS FROM 4 TO 50 GeV. Buffington, A.; Orth, C.D.; Smoot, G.F. (Space Sciences Laboratory and Lawrence Berkeley Laboratory, University of California, Berkeley). Astrophys. J. 199: No. 3, 669-679 (1 Aug 1975).

We have used a bremsstrahlung-identification technique to measure separate e^- and e^+ spectra in the primary cosmic rays from 4 to 50 GeV. Above our average geomagnetic cutoff of 4.0 GV/c, we find fluxes of 4.4 ± 0.3 e^- and 0.37 ± 0.09 e^+, m^{-2} sr^{-1}. The e^- events follow a differential power law whose spectral index is 2.8 ± 0.1. Our ratio $e^+/(e^+ + e^-) = 0.08 \pm 0.02$ implies traversal of an equivalent slab thickness of 4.3 ± 1.5 g cm^{-2} of interstellar and source material. (auth)

1498 PRODUCTION SPECTRA OF THE PARENTS OF VERTICAL COSMIC RAY MUONS. Thompson, M. G.; Whalley, M. R. (Univ. of Durham, Eng.). J. Phys., G (London); 1: No. 6, L48-L50(1 Aug 1975).

From measurements of the vertical sea level muon spectrum reported earlier this year by Ayre et al (J. Phys. G. Nucl. Phys.; 1: 584 to 600 (1975)), the exponent of the production spectrum of the muons' parents was calculated. As muon parents, pions and kaons decaying via the $K_{\mu 2}$ mode only were considered. There is an indication of a decrease in the value of the exponent of the pion production spectrum for $E_\pi > 100$ GeV which supports the suggestion of a flattening of the primary cosmic ray spectrum in the region 10^{12} to 10^{15} eV made by Wdowczyk and Wolfendale (J. Phys. A. Math. Nucl. Gen.; 6: 1594-611 (1973)). (auth)

1499 GIANT OLIVINE CHONDRULE AS A POSSIBLE LATER-STAGE PRODUCT IN THE NEBULA. Tanaka, T. (Geological Survey of Japan, Kawasaki); Nakamura, N.; Masuda, A.; Onuma, N. Nature (London); 256: No. 5512, 27-28(3 Jul 1975).

The presence is reported of an olivine chondrule in the Allende Meteorite having rare earth abundance features very different from those in any such material previously reported. The chondrule was extraordinarily large, 7 mm in diameter. Chemical analysis and x-ray diffraction examination indicated that the composition of this giant chondrule was much closer to pure olivine than that of the olivine chondrules previously examined. A stable isotope dilution technique was used for the determination of rare earths,

Ba, Sr and Rb abundances, and Ca and Al abundances were determined by atomic absorption spectroscopy. The abundances of common rare earths were about 40 times lower than in ordinary olivine chondrules, and there were definite anomalies for Ce and Eu. There were also anomalies for Ba, Sr, Ca, Al, Na and K. Results are shown tabulated, and suggestions are made for the origin of these anomalies. (UK)

1500 HEAVY NUCLEI OF THE COSMIC RADIATION IN THE UPPER ATMOSPHERE. Heinrich, W. Kiel; Univ. Kiel (1973). 56p. (In German). INIS.

Thesis.

In a series of balloon flights, the intensity of stopping heavy nuclei of cosmic radiation at a height of 22 km was measured with plastic detectors. The measured charge spectra, compared to the charge spectrum at the boundary of the atmosphere are changed by fragmentation. Nuclei with odd charge numbers, which are rare in the primary spectrum, are about as frequent in the atmosphere as the nuclei with even charge numbers. Intensities could be calculated from the primary spectra considering the energy loss and the fragmentation which agree with our own measured results and the measurements of other authors in an energy range of up to a few GeV/nucl. The parameters for fragmentation in air with which this agrees are similar to those for the fragmentation with collision on light nuclei in emulsion. The solar modulation and the radiation load due to heavy nuclei are discussed. (auth)

1501 COSMIC RAY PROPAGATION IN INTERPLANETARY SPACE. Voelk, H. J. (Max-Planck-Institut fuer Kernphysik, Heidelberg). Rev. Geophys. Space Phys.; 13: No. 4, 547-566 (Aug 1975).

The validity of the test particle picture and the approximation of static fields, as well as the spatial diffusion approximation, are discussed in a general way before specific technical assumptions are introduced. It is argued that the spatial diffusion equation for the intensity per unit energy has a much wider range of applicability than the kinetic (Fokker-Planck) equation it is derived from. This gives a strong weight to the phenomenological propagation theory. Its general success (and possible failure at small energies) for the modulation of galactic cosmic rays and solar events is described. Apparent effects like the "free boundary" are given disproportionate weight, since through them the connection to the detailed plasma physics of the solar wind is established. Greatest attention in detail is paid to the pitch angle diffusion theory. A general theory is presented that removes the well-known secularities of the quasi-linear approximation. The possible breakdown of any pitch angle diffusion theory at very small energies is perhaps connected to the observed "turn up" of the spectrum at low energies. A first attempt to derive the spatial dependence of the diffusion coefficient in the solar cavity, using such a divergence free scattering theory, is described and compared with recent observations out to 5 AU. (auth)

1502 COSMIC RAY INTENSITY GRADIENTS IN THE SOLAR SYSTEMS. McKibben, R. B. (Univ. of Chicago). Rev. Geophys. Space Phys.; 13: No. 3, 1088-1092(Jul 1975).

A review of studies in the heliocentric intensity gradient of galactic cosmic rays is given. Integral gradients, nucleonic radial gradients in differential energy windows, electron gradients in differential energy windows, theoretical studies, and observations of intensity gradients in heliographic latitude provide areas for discussion. (BJG)

1503 LOW-ENERGY SOLAR COSMIC RAYS: A BIBLIOGRAPHY. Roelof, E. C.; Krimigis, S. M. (Johns Hopkins Univ., Laurel, MD). Rev. Geophys. Space Phys.; 13: No. 3, 1092-1094 (Jul 1975).

This topological bibliography covers the following areas: proton events, solar radio bursts, propagation theory, the interplanetary magnetic field, electron events, solar x-ray bursts, interplanetary velocity anisotropies, interplanetary shock effects, solar flares, and solar neutrons and gamma rays. (BJG)

Stars

Refer also to abstracts 1488, 1606, 1609–1611, 1615–1617, 1619, 1679, 1685, 1759, and 2205.

1504 (COM-75-50010) THEORY OF EXTENDED STELLAR ATMOSPHERES. I. Computational Method and First Results for Static Spherical Models. Final Report. Mihalas, D.; Hummer, D. G. (National Bureau of Standards, Washington, D. C. (USA)). Oct 1974. 30p. Astrophys. J., Suppl. Ser.; 28: No. 265, 343-372(Oct 1974).

A method is presented that makes possible, for the first time, the calculation of extended spherical non-LTE model stellar atmospheres in hydrostatic and radiative equilibrium. This method is a generalization of the complete-linearization technique of Auer and Mihalas. These models are differentiated by the magnitude and radial dependence of a radiation force multiplier that is inserted into the equation of hydrostatic equilibrium to simulate the effect of radiation force on opacity sources which have not been included explicitly in the calculation. (GRA)

1505 GENERAL GEODESIC MOTION IN THE EXTENDED KERR MANIFOLD. St. John, R. H. Albuquerque, NM; Univ. of New Mexico (1974). 90p. University Microfilms Order No. 75-6977.

Thesis (Ph. D.).

The timelike and null geodesics in the Kerr metric describe important properties of the space surrounding a rotating black hole. The general characteristics of these geodesics, with an emphasis on those on the axis of symmetry and the equatorial plane, are found. On the axis of symmetry, the behavior of all timelike and null geodesics is completely described. The accessibility of various spaces added for geodesic completeness in the extended manifold is found by making local observations of geodesics in one coordinate patch from geodesics in another. The analysis on the equatorial plane shows that for a given angular momentum, P/sub phi/, if the energy, -P/sub t/, is in the range aP/sub phi//2mr/sub +/ less than -P/sub t/ less than aP/sub phi//2mr/sub -/, the geodesic, for r greater than r/sub +/, is in the I region and, for r less than r/sub -/, is in the III' region in Carter's version of the extended manifold. The energy and momentum of circular orbits, as functions of r and a, in the equatorial plane are found. The limits of the motion in the theta direction are found explicitly as functions of the constants of the motion. This analysis shows that there is geodesic motion on the equatorial plane that is unstable in the theta direction. This instability is most pronounced for all zero angular momentum unbound orbits; in this case, there is no minimum or maximum theta, and any perturbation could carry the geodesic to the axis of symmetry. Lastly, to show the nature of a surface containing theta geodesics, Carter's null surface is imbedded in a three dimensional Minkowski space. (Diss. Abstr. Int., B)

1506 NEUTRON STAR MODELS WITH REALISTIC HIGH-DENSITY EQUATIONS OF STATE. Malone, R.C.; Johnson, M.B. (Los Alamos Scientific Laboratory, University of California); Bethe, H.A. Astrophys. J. 199: No. 3, 741-748 (1 Aug 1975).

We calculate neutron star models using four realistic high-density models of the equation of state. We conclude that the maximum mass of a neutron star is unlikely to exceed $2\,M_{\odot}$. All of the realistic models are consistent with current estimates of the moment of inertia of the Crab pulsar. (auth)

1507 ON THE DIFFUSION OF LIGHT IN TURBULENT SHEARING MEDIA. Lerche, I. (Enrico Fermi Institute and Department of Physics, University of Chicago). Astrophys. J. 199: No. 3, 734-740 (1 Aug 1975).

We present some simple calculations to show that a beam of light is, in general, severely distorted and dispersed from the straight-line path that would obtain in vacuum when passing through a medium possessing a turbulent velocity of order c, the speed of light in vacuum. The motivation underlying these calculations is the problem of radiative transport through the magnetospheres of pulsars where particle energies in excess of about $10^{9}mc^{2}$ are believed to obtain. (auth)

1508 RESONANCE LINE TRANSFER WITH PARTIAL REDISTRIBUTION. V. THE SOLAR Ca II LINES. Shine, R.A. (Joint Institute for Laboratory Astrophysics, University of Colorado); Milkey, R.W.; Mihalas, D. Astrophys. J. 199: No. 3, 724-733 (1 Aug 1975).

Line profiles for the Ca II H and K lines have been calculated, accounting for the partial frequency coherence of scattered photons. These profiles are compared with calculations made with identical atomic and atmospheric models but assuming complete redistribution. Very significant differences between the profiles obtained using these two different physical descriptions of the scattering process are found, and it is now apparent that the assumption of complete redistribution is a serious oversimplification of the actual physical situation. The partial redistribution (PRD) results are in substantially better agreement with observation than the complete redistribution (CRD) profiles in describing (*a*) the center-to-limb behavior of the intensity at K_1 and K_2, (*b*) the center-to-limb behavior of the wavelength positions of K_1 and K_2, and (*c*) the relative behavior of the H and K profiles, as a function of wavelength, at disk center. Further, we find that we may match the observed absolute intensity at K_1 with a minimum chromospheric electron temperature of about 4450 K, and that HSRA temperature minimum is too low when partial redistribution effects are taken into account. This result raises questions about the validity of equating brightness temperatures observed at K_1 in stellar spectra with minimum temperatures in stellar chromospheres; it appears likely that such a procedure will systematically underestimate the value of T_{min}. (auth)

1509 GRAVITATIONAL RADIATION INSTABILITY IN ROTATING STARS. Friedman, J.L. (Laboratory for Astrophysics and

Space Research, University of Chicago); Schutz, B.F. Astrophys. J. Lett. 199: No. 3, L157-L159 (1 Aug 1975).

We have shown elsewhere that gravitational radiation leads to an instability to nonaxisymmetric perturbations in stars that are rotating rapidly enough to secularly unstable in Newtonian theory, and we explore here some astrophysical consequences. Neutron stars are unstable when $\langle\Omega\rangle$ exceeds 10^3-10^4 s^{-1} and lose their excess angular momentum in seconds. Unstable white dwarfs spin down to stability or to collapse in times that vary from weeks to 10^3 years. All stars with ergoregions are unstable; this fact imposes stringent upper limits on the rotation of relativistic configurations. (auth)

1510 RESONANCE LINE TRANSFER WITH PARTIAL REDISTRIBUTION. IV. A GENERALIZED FORMULATION FOR LINES WITH COMMON UPPER STATES. Milkey, R.W. (Kitt Peak National Observatory); Shine, R.A.; Mihalas, D. Astrophys. J. 199: No. 3, 718-723 (1 Aug 1975).

This paper describes a generalized formulation for treating partial redistribution effects in transfer problems in resonance lines with common upper states. The formulation allows explicitly for the possibility that several spectral lines may arise in transitions from a given upper level to several sharp lower levels, including, for example, the ground state and metastable states. (auth)

1511 STUDIES OF HEAVY-ELEMENT SYNTHESIS IN THE GALAXY. II. A SURVEY OF *e*-, *r*-, AND *s*-PROCESS ABUNDANCES. Butcher, H.R. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, Australian National University). Astrophys. J. 199: No. 3, 710-717 (1 Aug 1975).

Results are presented of a survey designed to search for variations in the relative abundances of *e*-, *r*-, and *s*-process elements in G-type dwarfs. Specifically, the abundances of Fe (*e*-process), Eu (*r*-process), and Ba (*s*-process) are examined in some 32 stars with as wide a range of ages, galactic orbits, and compositions as possible. No completely convincing relative abundance variations are found, to a limit of ±25 percent, although a slight enhancement of Eu in certain halo stars may be indicated. Abundances of Eu, Ba, and La are examined in the extreme halo giant HD 122563 and are found to be consistent with, but not as yet to prove, a nuclear (neutron exposure) history for the matter in that star different from the one in the Sun and most other stars. (auth)

1512 NONLINEAR EFFECTS IN DOUBLE-MODE CEPHEIDS. Stellingwerf, R.F. (Department of Astronomy, Columbia University). Astrophys. J. 199: No. 3, 705-709 (1 Aug 1975).

The effects of nonlinear mode interaction and period shifts in observed double-mode Cepheids are investigated with a detailed analysis of a mixed-mode pulsation model. Derived periods and mean constituent light curves agree well with the pure-mode nonlinear results and with the linear periods. Complete stability analyses indicate that low-mass Cepheid models show a periodic mixed-mode behavior near the red edge of the instability strip, as well as a mode switch near the center of the strip. It is proposed that these cases could be distinguished observationally, although available evidence favors the stable mixed-mode configuration for known double-mode Cepheids. These results are consistent with a mass for these objects that is much smaller than the expected Cepheid mass for the observed period range. (auth)

1513 EMISSION LINES IN THE HYDROGEN-DEFICIENT VARIABLE MV SAGITTARII NEAR MAXIMUM LIGHT. Herbig, G.H. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz). Astrophys. J. 199: No. 3, 702-704 (1 Aug 1975).

The H-deficient R CrB type variable MV Sgr near maximum light shows a rich emission spectrum in the 5800–8600 Å region. Most of these lines are due to Fe II, but Si II, N I, O I, and Hα also are present. Such a spectrum has not been observed in any other R CrB star, but there is some resemblance to ν Sgr. The emission lines in MV Sgr probably originate in an extended region of low temperature, which may also be responsible for the infrared excess observed by Feast and Glass. (auth)

1514 THE OB-type SUBDWARF HD 149382 AND THE NATURE OF THE SUBDWARF B STARS. Baschek, B. (Lehrstuhl für Theoretische Astrophysik, University of Heidelberg); Norris, J. Astrophys. J. 199: No. 3, 694-701 (1 Aug 1975).

High-dispersion spectra and monochromatic continuum measures of the subdwarf OB star HD 149382 have been obtained and analyzed to yield the atmospheric parameters $T_{\rm eff}$=40,000 K, log g=5.8. Helium is deficient by a factor 10 compared to Population I. Sulfur is the only element, other than hydrogen and helium, observed in the blue spectrum of this object. Analysis shows that, compared with Population I, it is overabundant by a factor of about 10, while all other heavy elements are probably underabundant. Comparison with other subdwarfs shows that HD 149382 together with Feige 66 represent intermediate cases between the subdwarf B and subdwarf O classes. It is suggested that the Bp stars, the subdwarf B stars, and the DA white dwarfs, all of which are weak-helium-line objects, define a high-temperature boundary in the (log g, $T_{\rm eff}$) -plane hotter than which purely surface peculiarities cannot exist. This hot boundary is identified with that at which radiation-pressure-driven mass loss, as suggested by Lucy and Solomon, removes the atmospheric layers on a short time scale. We also suggest that the degree of helium deficiency appears to increase with increasing gravity, as would be expected if diffusion were the cause of the peculiarity. Consideration of the space motions of 17 subdwarf B stars shows that a large proportion of this class belongs to the old disk population. We consider the implications of this result for the evolutionary status of these objects. In particular, if the subdwarf B stars are low mass, core-helium-burning objects on an "extended horizontal branch," as suggested by Greenstein, substantial mass loss is required. We conjecture that binary membership could lead to such a situation, and suggest that a search for duplicity in this class of objects would be profitable. (auth)

1515 CIRCUMSTELLAR LINES IN THE SPECTRUM OF ETA CANIS MAJORIS. Underhill, A.B. (Laboratory for Optical Astronomy, Goddard Space Flight Center, Greenbelt, Maryland). Astrophys. J. 199: No. 3, 691-693 (1 Aug 1975).

High-resolution scans made with the U1 and V1 scanners of the *Copernicus* satellite covering the centers of lines noted from low-resolution scans as possibly circumstellar in origin have been examined for the presence of sharp components. Three components are found displaced about −235 km s^{-1} from the line center. They indicate the presence of a cloud moving rapidly out of thes tar. Other sharp lines due to C II, N I, Mg I, Mg II, Si IV, and Fe II are observed. They originate in a circumstellar shell which is moving with a velocity of about - 25 Km s^{-1} with respect to the star. (auth)

1516 THE X—RAY STRUCTURE OF THE VELA SUPERNOVA REMNANT. Moore, W.E.; Garmire, G.P. (California Institute of Technology). Astrophys. J. 199: No. 3, 680-690 (1 Aug 1975).

The X-ray surface brightness distribution of the Vela supernova remnant is presented in three energy intervals on scales of 1.0 deg^2 and 0.44 deg^2. The 0.15–1.0 keV X-ray emission exhibits two principal regions of enhancement and a general limb brightening which may imply a shell-like source structure. (auth)

1517 FOUR-COLOR AND H beta PHOTOMETRY OF O-TYPE STARS. Crawford, D. L. (Kitt Peak National Observatory, Tucson, AZ). Publ. Astron. Soc. Pac.; 87: No. 518, 481-494(Aug 1974).

Kitt Peak data on O-type stars have been combined with those of Morrison (1975) to derive interstellar reddening slopes for the uvby system. The results are E(c_1) equals 0.20 E(b–y), E(m_1) equals -0.32 E(b - y), E(u - b) equals 1.5 E(b - y), and E(b - y) equals 0.74 E(B - V). (auth)

1518 PHOTOMETRIC CHARACTERISTICS OF YOUNG STARS. Mendoza V, E. E. (Universidad Nacional Autonoma de Mexico, Mexico City). Publ. Astron. Soc. Pac.; 87: No. 518, 495-497(Aug 1974).

Multicolor (UBVRIJHKL) photometric observations of 800 selected main-sequence stars were made. From these observations, the color-temperature relation for main-sequence stars was obtained. Intrinsic colors are defined from the mean colors of each spectral type. Normal main sequence stars are shown plotted on a two color diagram, and the reddening path for a normal extinction law line is drawn. Stars belonging to O and T associations (young stars) are shown to lie below the reddening paths of early type stars and normal main-sequence stars in the (V-R, K - L) plane. (1 fig) (GHT)

1519 lambda 3984 FEATURES IN THE MERCURY-MANGANESE STARS. Cowley, C. R.; Aikman, G. C. L. (Dominion Astrophysical Observatory, Victoria, B. C.). Publ. Astron. Soc. Pac.; 87: No. 518, 513-521(Aug 1974).

The isotopic shift of the Hg II lambda 3984 line is examined in the spectra of a number of strong mercury-manganese stars; the shift cannot be explained by line blending with lines of other elements in these stars, but represents real isotopic variations. An astrophysical log gf value of -1.8 is derived for lambda 3984, based on the Hg I lambda 4358 line strength in iota CrB and HR 1800. Elemental and (in some cases) isotopic abundances of Hg are derived using a spectrum synthesis technique; overabundances of up to 5.4 dex over the solar system mercury abundance are found; the maximum overabundances may be temperature dependent. (auth)

1520 HD 219460 AND THE OPEN CLUSTER Ma50. Crampton, D. (Dominion Astrophysical Observatory, Victoria, B. C.). Publ. Astron. Soc. Pac.; 87: No. 518, 523-525(Aug 1974).

The distance modulus of the young compact cluster Ma 50 is estimated to be 12.0 m +- 0.1 from spectroscopic observations of the brighter members. The radial velocity of the cluster is -81 +- 1 km s^{-1}. The absolute magnitude of the W-N 4.5 component of HD 219460 is M/sub nu/ equals -3.9 m +- 0.2; it is slightly less luminous than three stars of spectral type approximately

B0.5 which have evolved to luminosity class III stars. (auth) (auth)

1521 INTERESTING NEW SOUTHERN PECULIAR A STAR: HD137509. Cowley, A. P. (Dominion Astrophysical Observatory, Victoria, B. C.); Houk, N. Publ. Astron. Soc. Pac.; 87: No. 518, 527-528(Aug 1974).

A bright southern B star noted as peculiar from objective-prism plates is found to be rich in Si, Fe, Cr, and Ti but deficient in He. (auth)

1522 MASSES AND DIMENSIONS OF EARLY-TYPE BINARIES. Hutchings, J. B. (Dominion Astrophysical Observatory, Victoria, B. C.). Publ. Astron. Soc. Pac.; 87: No. 518, 529-535(Aug 1974).

In order to review the basic data on very massive stars, masses and radii are presented for all well-determined binaries of spectral type O and early B. These are derived from spectroscopic and photometric orbital parameters, in many cases using results and methods available in the last few years. The masses are consistent with those recently derived for single stars by Conti and Burnichon, which imply that Of star masses may exceed 60 M/sub solar mass/. Relationships between masses, temperatures, and radii are given, and compared with those for x-ray binaries. (5 figs, 2 tables, 21 refs) (auth)

1523 ABSOLUTE MAGNITUDES OF BARIUM STARS BASED ON THE WIDTH OF H alpha IN ABSORPTION. Kemper, E. (Univ. of California, Santa Cruz). Publ. Astron. Soc. Pac.; 87: No. 518, 537-540(Aug 1974).

Absolute magnitudes of Ba II stars determined from the width of H alpha indicate that these stars have, on the average, the luminosity of normal G and K giants. There may, however, be some Ba stars of luminosity class IV. The distribution of stars in absolute magnitude does not seem to depend on Ba line strength. (3 figs, 10 refs) (auth)

1524 COLOR INDICES OF GIANTS AND SUBGIANTS IN GLOBULAR CLUSTERS. Butler, D. (Univ. of Maryland, Baltimore). Publ. Astron. Soc. Pac.; 87: No. 518, 559-560(Aug 1974).

The globular-cluster metal-abundance parameter (B - V)/sub o, g,/ which is the intrinsic color index at the intersection of the horizontal and subgiant branch in the color-magnitude diagram, is shown to be tightly correlated with [Fe/H]. (auth)

1525 INTERSTELLAR REDDENING OF THE GLOBULAR CLUSTER 47 TUCANAE. Crawford, D. L.; Snowden, M. S. (Kitt Peak National Observatory, Tucson, AZ). Publ. Astron. Soc. Pac.; 87: No. 518, 561-563(Aug 1974).

We have estimated the interstellar reddening in front of 47 Tuc by observations of 26 foreground A- and F-type stars. The result is E(B - y) equals 0.021m. The zero point may be uncertain by as much as 0.013m. (auth)

1526 MEASURES OF METAL LINE BLOCKING IN 38 A-TYPE STARS. Danford, S. (Yale Univ., New Haven). Publ. Astron. Soc. Pac.; 87: No. 518, 577-585(Aug 1974).

The fraction of light blocked by metal lines in selected spectral regions is measured from coude spectra for 38 nearby A-type stars. Results are tabulated over the wavelength range 3300 A-5681 A and are useful for photometric systems employing the Oke bandpasses. Comparison with recent metal-line-blanketed stellar atmospheres is made. (auth)

1527 MARINER 9 OBSERVATIONS OF beta CEPHEI STARS. Lesh, J. R.; Bohlin, R. C. (Joint Inst. for Lab. Astrophysics, Boulder, CO). Publ. Astron. Soc. Pac.; 87: No. 518, 587-592 (Aug 1974).

Ultraviolet spectra of three beta Cep variables and a nonvariable star of similar spectral type were observed by the ultraviolet spectrometer on Mariner 9. A significant light variation at 1400 A may have been detected for beta Cep. The variable stars have mean ultraviolet spectra similar to that of the nonvariable star and do not show any significant short-period spectral variations. (3 figs, 11 refs) (auth)

1528 SIMULTANEOUS SPECTROSCOPIC AND PHOTOMETRIC OBSERVATIONS OF THE beta CEPHEI STAR HR 6684. Bolton, C. T.; Percy, J. R.; Shemilt, R. E. (Univ. of Toronto). Publ. Astron. Soc. Pac.; 87: No. 518, 595-598(Aug 1974).

We have obtained simultaneous radial velocity observations and differential magnitude observations of the beta Cep star HR 6684. The full amplitude of the velocity curve is 18 km sec^{-1} and the range in blue light is 0.033m. The ratio of these values is 550 km sec^{-1} mag^{-1} and maximum light falls at minimum radius. In these respects, HR 6684 is similar to other beta Cep stars. There is some evidence for a beat effect. The spectral lines are sharp (nu sin i equals 110 km sec^{-1}) and appear to vary in their profiles. (auth)

1529 Be STARS WITH LARGE MAGNITUDE CHANGES. Feinstein, A. (Universidad Nacional de La Plata, Argentina). Publ. Astron. Soc. Pac.; 87: No. 518, 603-605(Aug 1974).

Photoelectric UBV observations of 19 Be stars are listed which in a time interval of eleven years exhibit changes in V larger than DELTA V greater than 0.15m. Their light curves display very different shapes; no general rule for the light variation is evident. (auth)

1530 SPECTRAL TYPES OF FAINT ORION STARS. Breger, M.; Rybski, P. M. (Univ. of Texas, Austin). Publ. Astron. Soc. Pac.; 87: No. 518, 607(Aug 1974).

Spectral types for eleven Orion stars are presented. (auth)

1531 DETECTION OF A LINEAR POLARIZATION DECREASE IN THE H gamma LINE OF zeta TAURI. Hayes, D. P. (Columbia Univ., NY). Publ. Astron. Soc. Pac.; 87: No. 518, 609-611(Aug 1974).

A statistically significant linear polarization decrease is reported in the H gamma line of zeta Tau, an intrinsically polarized shell star. This result reinforces previous observations which indicated that unpolarized line emission could not completely account for the polarization reduction observed in the H gamma line of gamma Cas. (auth)

1532 NEW HELIUM SPECTRUM VARIABLE AND A NEW HELIUM-RICH STAR. Walborn, N. R. (Cerro Tololo Inter-American Observatory, La Serena, Chile). Publ. Astron. Soc. Pac.; 87: No. 518, 613-616(Aug 1974).

HD 184927, known previously as a helium-rich star, has been found to have a variable helium spectrum; the equivalent widths of five He I lines are larger by an average of 46 percent on a 1974 spectrogram than on one obtained with the same equipment in 1970. HD 186205 has been found to be a new, pronounced helium-rich star. (auth)

1533 AN INTERFEROMETRIC SEARCH FOR THE HULSE-TAYLOR BINARY PULSAR. Hjelming, R.M. (National Radio Astronomy Observatory, Charlottesville, Virginia); Gibson, D.M. Astrophys. J. Lett. 199: No. 3, L165-L166 (1 Aug 1975).

An interferometric search for continuum radio emission from the Hulse-Taylor binary pulsar made with the NRAO interferometer at 2695 and 8085 MHz has resulted in the detection of a weak source well within the positional error box of the binary pulsar and a relatively strong source several arc minutes outside the error box. (auth)

1534 AN UPPER LIMIT ON OPTICAL PULSATIONS FROM PSR 1913+16. Chanan, G.; Middleditch, J.; Nelson, J. (Lawrence Berkeley Laboratory, University of California, Berkeley). Astrophys. J. Lett. 199: No. 3, L167-L168 (1 Aug 1975).

A region of the sky covering the 2′ by 2′ error box of PSR 1913+16, a radio pulsar in a binary system, was searched for optical pulsations at the known pulsar frequency, and none were observed. We place an upper limit of 18.2 mag on any such pulsations. Within the smaller error box which has recently been suggested for this object, the limit is 19.2 mag. (auth)

1535 THE VARIABLE CIRCULAR POLARIZATION OF V1057 CYGNI. Wolstencroft, R.D.; Simon, T. (Institute for Astronomy, University of Hawaii). Astrophys. J. Lett. 199: No. 3, L169-L171 (1 Aug 1975).

Circular polarization of the visible light from V1057 Cygni has been detected. The magnitude and variability of this polarization imply that it is intrinsic to the star and not of interstellar origin. The linear polarization shows no evidence for variability and is therefore primarily interstellar. (auth)

1536 *SKYLAB* ULTRAVIOLET STELLAR SPECTRA: THE WOLF-RAYET STARS. Henize, K.G.; Wray, J.D.; Parsons, S.B.; Benedict, G.F. (Department of Astronomy, University of Texas at Austin). Astrophys. J. Lett. 199: No. 3, L173-L175 (1 Aug 1975).

Ultraviolet spectra showing emission lines in the 1300–2000 Å region have been obtained of 12 Wolf-Rayet stars. In the WN stars, lines of He II are dominant although N IV λ1718 and N III λ1805 are also present. C IV λ1549 absorption and a strong continuum in HD 151932, HD 93131, HD 92740 and HD 190918 indicate that all four stars have companions. In the WC stars, lines of C III and C IV dominate. N IV λ1718 and N III λ1805 emissions are probably present in HD 165763 and HD 156385. The ultraviolet spectra of γ Vel and θ Mus are dominated by supergiant companions. (auth)

1537 POPULATION I CEPHEIDS: THEORY AND OBSERVATION. Stobie, R. S. (Mt. Stromlo and Siding Spring Observatories, Canberra, Australia). pp 49-53 of Stellar Instability and Evolution. Ledoux, P. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on stellar instability and evolution; Canberra, Australia (16 Aug 1973).

The quantitative discrepancies between theory and observation with regard to population I Cepheids are discussed. The dis-

crepancies cannot be reconciled by mass loss or by changes in the luminosity or effective temperature of the variables. It is concluded that the present pulsation models, both linear and nonlinear, are in error. (IAA)

1538 THERMODYNAMICS OF DENSE HYDROGEN–HELIUM FLUIDS. Graboske, H. C. Jr. (Univ. of California, Livermore); Olness, R. J.; Grossman, A. S. Astrophys. J.; 199: No. 1, 255-264(1 Jul 1975).

The equilibrium thermodynamic properties of hydrogen-helium fluids are studied in the density-temperature regime appropriate to the interiors of evolving very low mass stars and giant planets. The low-density molecular fluid is treated by a free energy minimization method, utilizing several theoretical models and recent high-pressure experimental results for hydrogen. The high-density metallic fluid is treated by an extension of Thomas-Fermi theory. These approaches are combined to yield a detailed thermodynamic description for two fluids: pure hydrogen (X equals 1,) and a solar mixture (X equals 0.74, Y equals 0.24, Z equals 0.02). Equations of state are given for the density range 10^{-4} g cm^{-3} to 10 g cm^{-3} and a temperature range 200–60,000°K. (auth)

1539 EMPIRICAL DETERMINATION OF THE STAR DENSITY IN THE GALACTIC HALO WITH THREE-COLOR-PHOTOMETRIC METHODS IN THE DIRECTION TO M 13. Fenkart, R. P.; Wagner, R. (Univ., Basel). Astron. Astrophys.; 41: No. 3-4, 315-320(Jul 1975).

With the help of an RGU photometry we separated the disk- and halo-populations in a starfield in the direction to M13 (l = 58°, b = +40°) and determined their density-functions for different intervals in absolute magnitude. The assumption of rotational symmetry of the halo density distribution with respect to the galactic polar axis can be tested by a comparison of the results obtained in the present field with those obtained in the direction to SA 82 (l = 6°, b = +66°). The substantial discrepancies do not support the assumed symmetry, at least not for the neighbourhood of the test-plane covered by this investigation. (auth)

1540 MAGNETIC FIELD OF W SGR AND EVIDENCES FOR A PERIOD-MAGNETIC FIELD RELATION IN PULSATING VARIABLES. Weiss, W. W. (Univ. Observatory, Vienna); Wood, H. J. Astron. Astrophys.; 41: No. 2, 165-168(Jun 1975).

Four Zeeman plates of the Cepheid W Sgr taken at ESO/La Silla, Chile, were measured with the PDS 1000 microdensitometer of the Vienna Observatory. In three plates, a very weak magnetic field was measured. Simultaneous four-color and Hβ photometry is also presented on four of the nights of spectroscopy. For pulsating variable stars, a possible correlation between the maximum magnetic field and the period is found. (auth)

1541 MODEL OF THE X-RAY STRUCTURE OF THE CRAB NEBULA. Aschenbach, B.; Brinkmann, W. (Univ., Tuebingen, Ger.). Astron. Astrophys.; 41: No. 2, 147-151(Jun 1975).

We propose a model of the Crab nebula explaining the results of recent X-ray measurements which have been obtained by means of the lunar occultation techniques. Electrons are assumed to be accelerated radially outwards in the neighbourhood of the Crab pulsar to a distance of ~20″. The acceleration is not spherically symmetric, but is concentrated mainly within a region of limited angular extent around the rotational equatorial plane of the pulsar. There is expected only little steady emission within the acceleration domain, whereas outside the relativistic electrons start to emit synchrotron radiation. The proposed spatial orientation of the pulsar leads to an elliptically shaped configuration of the X-ray source elongated in a north-east-to-southwest direction. Even in the limit of very high frequency radiation the size would show a finite extent of ~40″ along the major and ~22″ along the minor axis. A motion of the pulsar and its magnetosphere relative to the centroid of the nebula may produce an enhanced emission northwest of the pulsar by magnetic field amplification. (auth)

1542 SPECTRAL OBSERVATIONS OF OF AND WOLF–RAYET STARS IN THE 0.8–1.1 μ RANGE. Andrillat, Y.; Vreux, J. M. (CNRS, Saint-Michel-l'Observatoire, France). Astron. Astrophys.; 41: No. 2, 133-136(Jun 1975). (In French).

Spectra of twenty-one O (mainly Of) and ten Wolf–Rayet stars have been obtained between 7000 Å and 12000 Å with a dispersion of 230 Å · mm^{-1}. The present paper deals with the O spectra; the WR ones are given for comparison. Our sample of O stars shows that if high temperature and low gravity are highly favorable for emission of He I 10830, they are not however either necessary or sufficient conditions to ensure emission of this line. In the spectra of HD 108, the width of this line exhibits a spectacular variation (a factor 2 at least) between August and November 1974. He II λ 10124 never is clearly visible. P_δ generally appears as a weak absorption line, but is in emission on the spectra of HD 108 in November 1974. C III λ 9713 never is a strong emission, even when both C III λ 5696 and C III λ 4649 are emission lines: this means that the mechanism pushing C III λ 4649 into emission is not as simple as suggested by Nussbaumer. (auth)

1543 STUDY OF THE NEBULAE S 206 AND S 209. Walmsley, C. M. (Max-Planck-Institut fuer Radioastronomie, Bonn); Churchwell, E.; Kazes, I.; LeSqueren, A. M. Astron. Astrophys.; 41: No. 2, 121-132(Jun 1975).

Radio continuum maps, radio recombination, H_2CO and H I absorption line measurements are presented for the optically visible nebulae S 206 (NGC 1491) and S 209 as well as for the neighboring radio source NRAO 150. Distances to the nebulae and physical parameters are obtained. Negative results from the formaldehyde observations suggest that there is no molecular cloud associated with these nebulae. (auth)

1544 SPECTROPHOTOMETRIC STUDY OF THE BE STAR HD 184279. Svolopoulos, S. N. (Univ. of Athens). Astron. Astrophys.; 41: No. 2, 199-202(Jun 1975).

Spectra of the Be star HD 184279 have been studied. The H_α-line appears in emission and its profile is given. The equivalent widths and the intensities of the measured absorption lines are also given. The lines observed in HD 184279 have led us to estimate the central star's atmospheric parameters, as well as those of its surrounding shell. (auth)

1545 INTERSTELLAR REDDENING IN THE LARGE MAGELLANIC CLOUD. Isserstedt, J. (Ruhr Univ., Bochum, Ger.). Astron. Astrophys.; 41: No. 2, 175-182(Jun 1975).

Interstellar reddening has been determined individually for 702 supergiants in the Large Magellanic Cloud (LMC) from the two-colour-diagram (for early type stars), and from the intrinsic colours $(B-V)_0$ using MK spectral types (for intermediate and late type stars). The following results were obtained: The scatter in the two-colour-diagram suggests a considerable amount of interstellar reddening. The space distributions of the brightest stars and of the most reddened stars are similar. The distribution of interstellar dust is dominated by the 30 Doradus association. Unreddened and strongly reddened stars often appear in projection on the celestial sphere very close to each other. No concentration of interstellar dust was found in the bar. The frequency distribution of color excesses and a normal error distribution is shown. The distribution of color excesses is identical for the good spiral tracers and for the rest. The distribution of the dust is compared to that of neutral hydrogen. The interstellar reddening as a function of the absorption-free apparent magnitude V_0 is shown. The systematically stronger reddening of the bright stars is probably due to circumstellar shells. Stars with reddenings $E_{B-V} \geq 0.30$m are individually discussed. (auth)

1546 NOTE ON THE BLUE STRAGGLERS IN NGC 7789. Pendl, E. S. (Univ., Bonn). Astron. Astrophys.; 41: No. 2, 239-240(Jun 1975).

A proper motion survey of the star cluster NGC 7789 revealed twelve stars beyond and blueward the turn-off point to be probable members of this cluster. A comparison of the present investigation with a radial velocity study by Strom and Strom (1970) establish the membership of at least four stars with near certainty. The most remarkable result is the long extent of the blue straggler sequence, which reaches to stars about five magnitudes brighter than the luminosity at the turn-off point. (auth)

1547 VARIABLE STAR BB CAM. Kazarian, M.; Terzan, A. (Observatoire de Lyon, Saint-Genis-Lavel, France). Astron. Astrophys.; 41: No. 2, 217-221(Jun 1975).

The photometric study of the variable star BB Cam results of a long series of photographic observations (m_{pg} and m_r) taken with the 80 cm and Schmidt telescopes of the Observatoire de Haute Provence. After the creation of two sequences of blue and red magnitudes in the field of the variable, the photometric measurements of 102 blue plates and 100 red plates allowed us to establish two light curves (m_{pg} and m_r). The following conclusions are reached: BB Cam is a red variable star with a long period (P = 142j ± 1) and CI = $\overline{m_{pg} - m_r} \cong +2.25$m. Period and amplitude change from one cycle to the other. Sometimes, the brightness changes very quickly, particularly in blue light. The star is redder in the maximum than in the minimum. BB Cam seems to be a pulsant semi-regular variable star type SRb. (auth)

1548 SEARCH FOR STELLAR FLARE ACTIVITY. Andersen, B. N.; Pettersen, B. R. (Univ. of Oslo). Astron. Astrophys.; 41: No. 3-4, 459-461(Jul 1975).

Criteria for flare star selection are derived, and a list of candidates is presented. The BG 12 filter is found suitable for flare star search with small telescopes. Flare activity is discovered on Gliese 109. (auth)

1549 PHYSICAL INVESTIGATIONS OF STAR CHAINS. Hahn, G.; Haupt, H. F. (Univ., Graz). Astron. Astrophys.; 41: No. 3-4, 447-450(Jul 1975).

The phenomenon of the star-chains as described by Oberguggenberger has been investigated in order to decide on the chains' physical reality. For 9 such objects, distributed over the northern sky, the distances of the single stars are given, for some even their space motions. UBV-photometry and objective prism plates data led to photometric parallaxes. Proper motions were derived from a comparison of newly taken plates with the Astrographic Catalogue or the AGK 2. In addition, all data available from the literature were used. For 8 chains the results show clearly no physical correlation between the single chain-stars, for one chain (K 5) the data are insufficient to decide whether such a correlation exists. For the star-chains as a whole the conclusion is drawn that they are a product of chance produced by projection to the sphere. (auth)

1550 MAGNETO-PARAMETRIC INSTABILITIES IN THE CRAB NEBULA. Sweeney, G. S. S.; Stewart, P. (Manchester Univ., Eng.). Astron. Astrophys.; 41: No. 3-4, 431-436(Jul 1975).

An analysis is given of the plasma instabilities associated with a strong low frequency electromagnetic wave propagating through a magnetized plasma. The results are discussed in relation to the Crab nebula. (auth)

1551 BOLOMETRIC CORRECTIONS FOR LATE-TYPE GIANTS AND SUPERGIANTS. Flower, P. J. (Inst. of Astronomy, Warsaw). Astron. Astrophys.; 41: No. 3-4, 391-394(Jul 1975).

Complete spectral energy distributions of giants, Mira variables, IRC stars, and the supergiants in h and x Persei and in Carina are used to calculate bolometric corrections for M 0 through M 10 stars. The new values agree quite well with those of previous investigators. The results indicate that the absolute values of bolometric corrections for supergiants are smaller than for giants. An effective temperature scale for giants is also given that, together with the bolometric corrections, can be used for accurate transformations of theoretical red giant branches onto color-magnitude diagrams. In deriving the bolometric correction scale the visual flux from the sun is found to be 1.83×10^{-1} W cm^{-2} μ^{-1} from solar irradiance data. This corresponds to an absolute flux from a star of apparent visual magnitude V = 0.00 of 3.70×10^{-12} W cm^{-2} μ^{-1}. (auth)

1552 FOUR-COLOR AND Hβ PHOTOMETRY OF β CEPHEI STARS AND THEIR LOCATION IN THE HERTZSPRUNG–RUSSELL DIAGRAM. Shaw, J. S. (Univ. of Georgia, Athens). Astron. Astrophys.; 41: No. 3-4, 367-373(Jul 1975).

New uvby–Hβ indices were determined for nine β Cephei stars and 22 suspects. Bolometric magnitudes and effective temperatures were derived for 21 known β Cephei stars and 30 suspects. Almost all β Cephei stars and a few suspects lie in the familiar instability strip in a $M_{bol}-T_e$ diagram. Counts of variables and non-variables in this region of the diagram indicate β Cephei stars are not solely in a secondary contraction or early shell-burning stage of their evolution. The possible use of four-color Hβ photometry and the instability strip to expedite search for new β Cephei stars is proposed. (auth)

1553 RINGS AND CHAINS IN SIMULATED STELLAR FIELDS. Lindemann, E.; Burki, G. (Observatory, Geneva). Astron. Astrophys.; 41: No. 3-4, 355-358(Jul 1975).

Stellar fields are simulated by means of coordinates generated by random numbers. The diameters of stars in those simulated fields are defined according to a magnitude-like distribution. An equivalent surface of about 8.3 sq.deg. of sky at low galactic latitude is plotted. We obtain frequencies of stellar rings and chains of the same order of magnitude as in real fields. This suggests that at least a large part of the stellar rings and chains could be due to random arrangements of stars. (auth)

1554 DYNAMICAL TIDE IN CLOSE BINARIES. Zahn, J. P. (Observatory, Nice). Astron. Astrophys.; 41: No. 3-4, 329-344(Jul 1975).

The non-adiabatic oscillations of a star, driven by an outer rotating gravitational field, have been studied by the use of matched asymptotic expansions. The interior and envelope solutions in this procedure are derived in Sections 2 and 3. The results apply to stars which have a convective core and a radiative envelope, and they are discussed in Section 4. We find that the resonances of the free gravity modes are damped by radiative dissipation, which operates in a relatively thin region below the surface of the star. Due to that dissipation, some properties of the dynamical tide have observable consequences in close binary systems: A torque is applied to a binary component; this serves to make it corotate with its companion in a time which can be short compared to its nuclear life. Before that synchronization is achieved, the brightness distribution over the surface of the star is in general phase shifted relative to the external driving potential. (auth)

1555 OBSERVATION AND THEORY OF MG II LINES IN EARLY TYPE STARS. Snijders, M. A. J. (Vrije Univ., Brussels); Lamers, H. J. G. L. M. Astron. Astrophys.; 41: No. 3-4, 245-257(Jul 1975).

The profiles of the Mg II lines at 2795.5 and 2802.7 Å (3^2S-3^2P), 2790.7 and 2798.0 Å (3^2P-3^2D), 4481.1 and 4481.3 Å (3^2D-4^2F) are computed in a grid of model atmospheres with $8000 \leq T_{eff} \leq 35000$ K and $2.5 \leq \log g \leq 4.0$ by means of LTE and non-LTE theories of line formation. The effects of the various physical assumptions on the strength of the Mg II lines are discussed. The lines are sensitive to the amount of UV line blocking in atmospheres of $T_{eff} \leq 15000$ K. The inclusion of the optically forbidden 3s–3d transition is important for the evaluation of the 3d-level population. The cores of the lines are strengthened by the non-LTE effects over the entire effective temperature range. In the cooler models the wings of the resonance lines are weaker than in LTE. Very large deviations from LTE occur in the hot low gravity models, especially in the lines which are weak in LTE. The equivalent width, the central depression and the full half-width of the lines are presented in a form useful for a comparison with the observations. (auth)

1556 OBSERVATIONS AND THEORY OF MG II LINES IN EARLY TYPE STARS. III. The Observations and a Comparison with the Predictions. Lamers, H. J. G. L. M. (Astronomical Inst., Utrecht); Snijders, M. A. J. Astron. Astrophys.; 41: No. 3-4, 259-272(Jul 1975).

The equivalent width of the ultraviolet Mg II lines from the 3s–3p and 3p–3d transitions in the spectra of 106 stars and of the visual lines from the 3d–4f transition in 48 stars of types O 4 to A 3 are presented. The ultraviolet observations were made by the Orbiting Stellar Spectrophotometer S 59, the Copernicus Satellite and various balloon experiments. The visual observations were collected from the literature. (auth)

1557 DIAMETER FUNCTION FOR SUPERNOVA REMNANTS AND THEIR EVOLUTION. Smith, H. Jr. (Univ. of South Florida, Tampa). Astron. Astrophys.; 41: No. 3-4, 273-277(Jul 1975).

The data on the diameter function for supernova remnants is re-examined. In contrast to previous studies, we find a discrepancy between the adiabatic-expansion prediction and the data. Possible explanations, including error in the surface brightness-diameter (Σ–D) relation, are examined. (auth)

1558 VIBRATIONAL INSTABILITY OF A 1 $M_\odot$ STAR TOWARDS NON-RADIAL OSCILLATIONS. Boury, A.; Gabriel, M.; Noels, A.; Scuflaire, R.; Ledoux, P. (Univ., Liege). Astron. Astrophys.; 41: No. 3-4, 279-285(Jul 1975).

The vibrational stability for non-radial oscillations of a 1 $M_\odot$ star during the main sequence phase is studied. The star becomes unstable at an age of 2.4×10^9 years. Stability is restored after three billion years. (auth)

1559 STUDY OF HR 3018, HD 91324, AND α CRV AND ITS IMPLICATION FOR THE AGE-ABUNDANCE CORRELATION OF THE NEIGHBOR STARS. da Silva, L. (Observatoire Nacional, Rio de Janeiro). Astron. Astrophys.; 41: No. 3-4, 287-300(Jul 1975).

The stars HR 3018, HD 91324 and α Crv have been analyzed using large dispersion spectrograms with a differential model atmosphere analysis. The possibility of systematic errors was checked by using the spectra taken of the moon. A careful determination of T_{eff}, log g, abundance, micro-turbulence and rotational velocity of the stars has been made. (auth)

1560 DEPOLARIZATION OF FIVE SUPERNOVA REMNANTS: INTERNAL AND EXTERNAL FARADAY EFFECTS. Velusamy, T.; Kundu, M. R. (Univ. of Maryland, College Park). Astron. Astrophys.; 41: No. 3-4, 307-314(Jul 1975).

Depolarization in five supernova remnants Kes 69, W 44, IC 443, 3 C 10 and 3 C 58 has been investigated using the polarization measured at 2.8, 6, 11 and 21 cm with equivalent resolutions. The polarization data for certain regions in Kes 69, W 44 and IC 443 would be best interpreted if it were assumed that the depolarization is caused by an internal Faraday effect in the source. The physical parameters such as the internal and external rotation measures and the degree of inhomogeneity within the source have been derived from source models for internal depolarization. The sources Kes 69, W 44 and IC 443 seem to have large internal rotation measures and the rotation of the plane of polarization suggests deviations from the λ^2-law at long wavelengths. 3 C 10 and 3 C 58 have very small internal Faraday effects. A possibility of depolarization due to the observed variations of the external rotation measure across the remnants is also examined. In either case, the depolarization was found to be negligible at 2.8 cm in all these sources. When internal Faraday rotation effects are present, the frequently assumed λ^2-law for the rotation of the plane of polarization is found to be valid only for wavelengths shorter than a critical value which in turn depends on the amount of internal Faraday rotation in the source. (auth)

1561 SPECTROSCOPIC AND PHOTOMETRIC OBSERVATIONS OF HDE 269006 IN THE LARGE MAGELLANIC CLOUD. Wolf, B. (European Southern Observatory, Santiago de Chile). Astron. Astrophys.; 41: No. 3-4, 471-473(Jul 1975).

High dispersion spectra of HDE 269006 of the Large Magellanic Cloud are compared with spectra of S Dor of the same dispersion. The visual magnitude of HDE 269006 has monotonously increased during the 23 day interval from Oct. 20 to Nov. 13, 1974 by 0.08 mag. During three full nights HDE 269006 was photometrically monitored. Significant short term variations on a time scale of a few hours were found in V, B−V, and U−B on Nov. 12, 1974.

1562 SUPERNOVAE. Pskovskii, Yu. P. pp 261-337 of Nonsteady-state Phenomena and Stellar Evolution. Boiarchuk, A. A. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

Supernovae are defined and classified, and the photometric properties of extragalactic supernovae are discussed. The statistical characteristics of the principal types of supernovae are examined, and their spectra are described. Some results of the spectral analysis of supernovae shells are given, together with observations of galactic supernovae and remnants of supernovae shells. The problem of supernovae explosion is studied, treating pulsars as remnants of such explosions. (IAA)

1563 GALACTIC-HALO VARIABLE STARS IN LONG ESTABLISHED STELLAR CLUSTERS. Kukarkin, B. V. pp 151-180 of Nonsteady- State Phenomena and Stellar Evolution. Boiarchuk, A. A. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The current status of our knowledge of stars in stellar clusters and in complex stellar systems of the type of our Galaxy, whose age exceeds 5 billion years, is reviewed. The stars under consideration include regular and semiregular red variable stars, and stars of the type of Mira Cet, W Vir, RV Tau, and RR Lyr, as well as close binary stars. (IAA)

1564 CHARACTERISTICS AND EVOLUTION OF CLOSE BINARY SYSTEMS. Svechnikov, M. A.; Snezhko, L. I. pp 181-230 of Nonsteady-State Phenomena and Stellar Evolution. Boiarchuk, A. A. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

Eclipsing binaries are classified into seven groups, and the characteristics of each group are discussed. The position of the binary components in the Hertzsprung-Russell diagram is examined, along with the mass-luminosity and mass-radius relations. The periods, semimajor axes, orbital moments, and evolution of close binary systems are studied, along with the characteristics of subgiants in binary systems. (IAA)

1565 VARIABLE STARS IN YOUNG CLUSTERS AND IN THE GALACTIC DISK. Efremov, Yu. N. pp 13-46 of Nonsteady-State Phenomena and Stellar Evolution. Boiarchuk, A. A. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The variability in the gravitational contraction stage of stars in young open clusters is discussed with particular reference to T Tau, UV Cet, beta Cep, FU Ori, RR Lyr, and delta Sct stars. The evolution of these stars is analyzed. The characteristics of red variable stars (red giants and supergiants) are examined. (IAA)

1566 SOFT X-RAY OBSERVATIONS OF SUPERNOVA REMNANTS. Zarnecki, J. C. (University Coll.; London); Culhane, J. L.; Fabian, A. C.; Rapley, C. G.; Boyd, R. L. F.; Parkinson, J. H.; Silk, R. pp 565-572 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

Observations of a number of supernova remnants have been carried out with the low energy X-ray telescope on the Copernicus satellite. Data are presented on the X-ray structure of the remnants Cassiopeia A and Puppis-A. Marginal detections or new upper limits are reported for the remnants IC443, DR4, MSH15-52A, Downes 83, Downes 84, and 3C392. (IAA)

1567 HIGH RESOLUTION SPECTRA OF M AND C STARS BY FOURIER TRANSFORM SPECTROSCOPY. Maillard, J. P. (CNRS, Orsay, France). pp 269-284 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

1568 MEDIUM RESOLUTION STELLAR SPECTRA IN THE TWO-MICRON REGION. Hyland, A. R. (Mt. Stromlo and Siding Spring Observatories, Canberra, Australia). pp 307-326 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

The astrophysical implications of available medium resolution spectra in the limited wavelength range from 1.9 to 2.5 microns are considered. Observational techniques are discussed along with features observable at medium resolution. Attention is given to molecular bands of carbon monoxide, water, and cyanogen. Identified atomic features are related to hydrogen, helium, silicon, magnesium, and titanium. Empirical band strength-color relationships are examined, taking into account carbon monoxide in G5-M8 giants and supergiants, the isotopic C-12/C-13 abundance ratio, and water vapor band strengths in late-type stars. (IAA)

1569 SPECTROPHOTOMETRY OF SUPERNOVAE. Kirshner, R. P. (Hale Observatories, Pasadena, CA). pp 533-544 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

Studies were made of a type II supernova (SN 1970g in M 101) and a type I supernova (SN 1972e in NGC 5253) covering the wavelength range from 3200 to 10,000 A. The absolute spectral energy distributions show that both types have a continuum that varies slowly and uniformly with time and carries the bulk of the radiated flux at early epochs. Some lines in both types have P Cygni profiles; broad emissions with broad absorptions at their violet edges. Some lines are common to both types and persist throughout the evolution of the spectrum. (IAA)

1570 KINEMATICS AND AGES OF STARS IN GLIESE'S CATALOGUE. Wielen, R. (Heidelberg Universitat). pp 395-407 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

Gliese's catalog is the most complete collection of stars within 20 pc. There are, however, aspects of bias due to selection effects. The catalog is, therefore, not fully representative for all the nearby stars. Attention is given to the luminosity function, age groups in the color-magnitude diagram, questions of age classification according to the Ca II emission, and aspects of vertex deviation. Representative common nearby stars are discussed. (IAA)

1571 SCANS AND NARROW-BAND PHOTOMETRY OF LATE-TYPE STARS IN THE ONE-MICRON REGION. Wing, R. F. (Perkins Observatory, Delaware, OH). pp 285-306 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

A summary is given of the molecular bands occurring in the near-infrared spectra of cool stars, especially those having sufficient strength and freedom from contamination to be measurable by narrow-band photometry. In some cases, useful indices of both temperature and luminosity can be obtained from such measurements. Several bands remain unidentified, including the 9910-A band in late M dwarfs and at least nine bands in cool S stars. Three topics of a spectroscopic nature are discussed: in Mira variables, grossly different spectral types are sometimes obtained from zero-volt and excited TiO bands of the same band system; a few M stars have been found to show bands of both VO and CN at the same time. They may be the coolest known supergiants, although there remains some doubt as to their luminosities; the first results are given from a program of measuring crude ratios of C-12 to C-13 from narrow-band photometry of sensitive points on the profile of the delta v = +2 band sequence of CN. (IAA)

1572 HIGH RESOLUTION INTERFEROMETRY OF COOL STARS. Lambert, D. L. (Univ. of Texas, Austin). pp 237-254 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

A description is given of results obtained in a program of infrared high resolution spectroscopy of cool stars. The nature of infrared stellar spectra is considered along with questions regarding astrophysics and stellar infrared spectroscopy. An abundance analysis for alpha Ori (Betelgeuse) is conducted. The C-12/C-13 abundance ratio is examined and attention is given to the O-16/O-18 and O-16/O-17 abundance ratios. M stars and SiO vibration-rotation bands are discussed and questions regarding the characteristics of the molecular hydrogen quadrupole vibration-rotation lines are explored. (IAA)

1573 MASSIVE BLACK HOLES IN GLOBULAR CLUSTERS. Bahcall, J. N. (Inst. for Advanced Study, Princeton); Ostriker, J. P. Nature (London); 256: No. 5512, 23-24(3 Jul 1975).

It is suggested that globular cluster x-ray sources may represent a very different phenomenon from binary x-ray sources, and that the x-ray emission may be caused by accretion of gas on to a massive black hole at the center of the cluster. This suggestion is consistent with theories of stellar and cluster evolution, and with other observations on clusters. Possible sources of accretional mass are discussed. Most of the gas will be ionised by UV radiation from stars in the cluster, as well as by the x-radiation from the vicinity of the black hole. The suggestion is discussed theoretically. The model considered leads to predictions that the x-ray emission should be point-like and located at the center of the globular cluster, and there should be no eclipses, orbital or spin periods observable in the x-rays. It is conceivable that a pair of massive black holes, or a swarm of lower mass condensed objects, would have evolved dynamically to a single central rotating black hole through many-body interactions and gravitational radiation. Consideration is given to the reasons why only a small fraction of the globular clusters in the Galaxy are x-ray sources. (UK)

1574 BINARY PULSAR 1913 + 16. van den Bergh, S. (Univ. of Toronto, Richmond Hill, Ont.). Astrophys. Lett.; 16: No. 2, 75(1975).

The a priori probability that the only known binary radio pulsar should also have the second shortest period known is only ~0.02. This suggests that the spin-down of PSR 1913 + 16 may have been slowed down or even reversed by mass transfer. (auth)

1575 X-RAY EMISSION FROM U GEMINORUM AND THE RADIO SPUR AT $l \simeq 200°$. Novich, R.; Woltjer, L. (Columbia Univ., New York). Astrophys. Lett.; 16: No. 2, 67-69(1975).

Rocket X-ray data on U Geminorum obtained at phase 0.062 during a quiescent period are shown to yield an upper limit of 7×10^{31} ergs sec^{-1} for the X-ray luminosity in the 150 to 280 eV band. This limit is compared with the recent reported X-ray observation of SS Cygni during an active period and the prediction of Warner's model for U Gem. It is suggested, in agreement with Berkhuijsen, that a soft X-ray feature at $l \simeq 200°$, $b \simeq +20°$ arises from a radio spur at that location. (auth)

1576 INTRINSIC MAGNETIC POLARIZABILITY CONTRIBUTION TO THE SUSCEPTIBILITY OF DENSE NEUTRON MATTER. Bernabeu, J. (CERN, Geneva); Ericson, T. E. O.; Ferro Fontan, C. Astrophys. Lett.; 16: No. 2, 57-59(1975).

It is shown that, apart from the neutron interaction contribution to the susceptibility of neutron stars, there is an additional contribution coming from the magnetic polarizability β_n of individual neutrons. For $\beta_n \approx 10^{-4}$ fm^3, this part overwhelms the interaction contribution for $k_F \gtrsim 3.5$ fm^{-1}. No transition to ferromagnetic state is predicted in the interesting density region. (auth)

1577 PULSAR GLITCHES AND RESTLESSNESS AS A HARD SUPERFLUIDITY PHENOMENON. Anderson, P. W.; Itoh, N. (Cambridge Univ., Eng.). Nature (London); 256: No. 5512, 25-27 (3 Jul 1975).

Reference is made to what is termed "restless" behavior of pulsar periods. This has been regarded as due to "microquakes" in the crust. A glitch has also been observed in PSR1508 + 55. It is here suggested that the behavior can equally well be explained by "noisiness" in the rate of creep of vorticity through a neutron superfluid in the crust, which is analogous to the well known "noisy" behaviour of flux creep in hard superconducting magnets. Macroglitches, especially those in the Vela pulsar, may be caused by catastrophic release of pinned vorticity. The lower crust of a neutron star contains large nuclei bathed in a neutron Fermi gas which is superfluid. Some suggestions are made as to the physics of superfluidity in a pulsar. (UK)

1578 WOLF–RAYET STARS. Rublev, S. V.; Cherepashchuk, A. M. pp 47-124 of Nonsteady-State Phenomena and Stellar Evolution. Boiarchuk, A. A. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The continuous and line spectra, absolute magnitudes, and chemical composition of single (Population I) WR stars are discussed, along with the shell temperatures, the Sastra core temperatures, the balometric luminosity and radii of the cores, and the dynamic state and physical parameters of the atmospheres. The characteristics of WR stars in close binary systems is studied, with particular reference to their spatial distribution, the effects of closeness of the components, the physical variability of the components, and the satellites of WR binaries. Some results of spectroscopic, polarimetric, and photometric investigations are reviewed, and the evolution of WR stars is examined. (IAA)

1579 NOVYE I SVERKHNOVYE ZVEZDY. (Novae and Supernovae). Pskovskii, Yu. P. Moscow; Izdatel'stvo Nauka (1974). 207p.

The present work reviews the state of knowledge concerning novae and supernovae, and describes the main features of research in this field. Various observational data are presented, and theories and models of the processes which take place in nova outbursts are described in their main features without complex mathematical treatment. The structure and properties of supernova remnants are discussed, and in particular, the radio, optical, and X-ray emissive properties of pulsars are considered. The basic features of neutron stars, as the final stage in stellar evolution, are also examined. (IAA)

1580 IAVLENIIA NESTATSIONARNOSTI I ZVEZDNAIA EVOLIUTSIIA. (Nonsteady-State Phenomena and Stellar Evolution). Boiarchuk, A. A.; Efremov, Yu. N. (eds.). Moscow; Izdatel'stvo Nauka (1974). 375p.

The papers deal with supernovae, X-ray sources, and several types of stars that are unsteady in the sense of their spectral characteristics, rather than in the sense of variability of brightness. Several types of variable stars are studied in terms of a specific stage of development of large- and small-mass stars. Young hot variable stars with extended atmospheres, such as Wolf–Rayet stars and emitting B stars, are investigated, along with the characteristics of the evolution of close binaries. Some of the problems studied are of particular interest to modern astronomy. (IAA)

1581 HADRONIC MATTER. Koebke, K. Wuerzburg, Ger.; Wuerzburg Univ. (1973). 56p. (In German). INIS.

Thesis.

The Hagedorn thermodynamic model of strongly interacting elementary particles can be used to describe hadronic matter. The consequences of the thermodynamic equation of state for the hadronic core of neutron stars and the early evolution of the cosmos are discussed. (auth)

1582 SOME TIME-DEPENDENT PHENOMENA OF PULSARS. Hesse, K. H. Bonn; Bonn Univ. (1974). 124p. INIS.

Thesis.

Time-dependent phenomena were studied in detail. Theories, observations, pulse intensity variations, pulse profiles and pulsars at two frequencies are discussed. A review of certain theoretical papers directly related to these investigations is given, and an interpretation of the observations is attempted. (auth)

1583 CORONAL MAGNETIC FIELD MODELS. Schatten, K. H. (Victoria Univ. of Wellington, New Zealand). Rev. Geophys. Space Phys.; 13: No. 4, 589-592 (Aug 1975).

A review of the development of coronal magnetic field models is presented. Each model's assumptions are discussed with reference to their validity within the solar corona. It is pointed out how remarkable it is that electrodynamics is applicable on a large scale as well as on the small scale from which it originated. (auth)

1584 DIELECTRIC PROPERTIES OF THE MAGNETIC SURFACE OF NEUTRON STARS. Ventura, J. New York; City Univ. of New York (1975). 180p. University Microfilms Order No. 75-13,643.

Thesis (Ph. D.).

The effect of the pulsar magnetic field estimated at approximately 10^{12} – 10^{13} G on the dielectric properties of the nonrelativistic surface plasma of the neutron star is examined. Making use of quantum theory explicit expressions for the dielectric tensor epsilon/sub alpha beta/ which governs the propagation of electromagnetic waves are obtained. Deviations from the magnetoionic theory have been carefully explored in the long wavelength approximation. A numerical study is also given for a "one-dimensional" electron gas, where only the ground state Landau level is occupied. It was possible to establish the magnetoionic modes for a surprisingly broad range of physical parameters. The last part of the study is devoted to the effect of collisions in the magnetic surface. The geometry of a scattering event is drastically affected by the presence of the magnetic field. Explicit and general expression were obtained for the scattering cross-section and collision frequency in the magnetic field. A reduction of the effective collision frequency with increasing magnetic field strength is found. (Diss. Abstr. Int., B)

1585 USE OF SUPERNOVAE LIGHT CURVES FOR TESTING THE EXPANSION HYPOTHESIS AND OTHER COSMOLOGICAL RELATIONS. Rust, B. W. Urbana, IL; Univ. of Illinois (1974). 382p. University Microfilms Order No. 75-11,539.

Thesis (Ph. D.).

This thesis is primarily concerned with a test of the expansion hypothesis based on the relation DELTA t/sub obs/ equals (1 + V/sub r//c)DELTA t/sub int/ where DELTA t/sub int/ is the time lapse characterizing some phenomenon in a distant galaxy, DELTA t/sub obs/ is the observed time lapse and V/sub r/ is the symbolic velocity of recession. If the red shift is a Doppler effect, the observed time lapse should be lengthened by the same factor as the wave length of the light. Many authors have suggested type I supernovae for such a test because of their great luminosity and the uniformity of their light curves, but apparently the test has heretofore never actually been performed. Thirty-six light curves were gathered from the literature and one (SN1971i) was measured. All of the light curves were reduced to a common (m/sub pg/) photometric system. The comparison time lapse, DELTA t/sub c/, was taken to be the time required for the brightness to fall from 0.5 m below peak to 2.5 m below peak. The straight line regression of DELTA t/sub c/ on V/sub r/ gives a correlation coefficient significant at the 93 percent level, and the simple static Euclidean hypothesis is rejected at that level. The regression line also deviates from the prediction of the classical expansion hypothesis. Better agreement was obtained using the chronogeometric theory of I. E. Segal (1972 Astron. and Astrophys. 18, 143), but the scatter in the present data makes it impossible to distinguish between these alternate hypotheses at the 95 percent confidence level. The question of how many additional light curves would be needed to give definite tests is addressed. It is shown that at the present rate of supernova discoveries, only a few more years would be required to obtain the necessary data if light curves are systematically measured for the more distant supernovae. (Diss. Abstr. Int., B)

1586 ULTRAVIOLET OBSERVATION OF CLASSICAL CEPHEIDS BY OAO-2. Hutchinson, J. L. Madison, WI; Univ. of Wisconsin (1974). 235p. University Microfilms Order No. 74-28,808.

Thesis (Ph. D.).

Ultraviolet observations of the five classical cepheids RT Aur, delta Cep, beta Dor, Y Oph and alpha UMi obtained by the Wisconsin Experiment Package on OAO-2 are reported. For the most part, the temporal ultraviolet behavior is found to mimic that of the visible region but with much larger amplitudes; the amplitude shows a strong linear correlation with wave number. In addition to the large body of observations for these five cepheids, a few observations of eta Aql, FF Aql and zeta Gem are included. Due to the faintness of late-type stars in the ultraviolet, the best cepheid data were produced by the filter photometers at effective wavelengths of 4250 A, 3350 A, 3075 A, 2590 A and 2210 A. Light curves of beta Doradus exhibit significant differences at ultraviolet and visible wavelengths. Comparison of the ultraviolet and ground-based photometry with flux constant, plane-parallel line blanketed model atmospheres is performed to provide values of effective temperature and surface gravity. The Wesselink Method of obtaining stellar radii is examined in light of the large change in the amplitude of light variation with wavelength. (Diss. Abstr. Int., B)

1587 RADIATIVE TRANSFER IN SPHERICAL CIRCUMSTELLAR DUST ENVELOPES. Apruzese, J. P. Madison, WI; Univ. of Wisconsin (1974). 117p. University Microfilms Order No. 74-28,790.

Thesis (Ph. D.).

A summary of the observational evidence for the existence of circumstellar dust envelopes is given. A generalization of the mathematical techniques of Huang is developed for calculations of the transfer of radiation through spherical circumstellar dust shells. This generalization removes Huang's simplifying assumption of an Eddington Factor of 1/3, and also allows the calculation of the full spectral distribution of the radiation throughout the envelope. The effect of errors in the Eddington Factor (equalsK/J) on the transfer calculation is investigated. The technique is applied in an attempt to model several well observed infrared objects. It is found that for a wide range of envelope geometries, infrared opacities significantly larger than those which calculations of nonsilicate grains yield are required to fit the spectral distributions of the objects. The ten-micron "bump" in the infrared spectrum of the supergiant VX Sgr has been theoretically investigated and it is found that no similar bump in the grain emissivity profile is needed to produce the observed bump. However, a similar spectral peak in the G supergiant HR5171 is found to be reflected in the grain emissivity profile. The reasons for this seeming anomaly are discussed. (Diss. Abstr. Int., B)

1588 CARBON DETONATIONS IN RAPIDLY ROTATING STELLAR CORES. Mahafey, J. H. Boulder, CO; Univ. of Colorado (1974). 126p. University Microfilms Order No. 75-13,447.

Thesis (Ph. D.).

Equilibrium models have been constructed for rapidly rotating isothermal cores with central densities of 2×10^9, 6×10^9, and 10^{10} g/cm^3, and with a temperature of 3×10^8 K. It is noted that the absolute values of the total energies of these cores is always exceeded by the total available nuclear energy. Detonations are initiated in the center of some of these models, and the subsequent dynamics are followed with an axially symmetric, two dimensional Eulerian hydrodynamic code. It is found that the presence of rotation does not lower the central density required for producing a bound remnant down to the density range at which current evolutionary calculations predict the explosive ignition of carbon. Hence, the fundamental results of previous spherically symmetric calculations, that 4 to 8 M/sub solar mass/ stars are totally disrupted after carbon ignition, is not altered by this work. (Diss. Abstr. Int., B)

1589 STRUCTURE AND STABILITY OF RELATIVISTIC, DIFFERENTIALLY ROTATING STARS. Seguin, F. H. Pasadena, CA; California Inst. of Tech. (1975). 105p. University Microfilms Order No. 75-12,518.

Thesis (Ph. D.).

The stability of axisymmetric, differential rotation in nonmagnetic stars of uniform chemical composition is studied in the context of general relativity theory. Criteria are found for stability against local, linear, axisymmetric perturbations in conducting, viscous stars and in perfect fluid models. Applications of the stability conditions to models of specific astrophysical objects are discussed. The equations of hydrodynamics in the post-Newtonian approximation to general relativity are applied to differentially rotating, barytropic stars. In this approximation the equation of hydrodynamic equilibrium can be integrated to yield a simple algebraic equation, and the gravitational field equations can be written in easily handled integral forms; these facts make possible an iterative scheme of the "self-consistent field method" type which can be used to construct numerical models. (Diss. Abstr. Int., B)

1590 SPACE DENSITY AND KINEMATICS OF DWARF M STARS. Smethells, W. G. Cleveland; Case Western Reserve Univ. (1974). 109p. University Microfilms Order No. 75-5089.

Thesis (Ph. D.).

The results of an objective-prism survey for dwarf stars, K7 and later, are presented. One hundred twenty-one red sensitive plates covering 1720 sq. deg. of the southern sky were obtained with the Curtis Schmidt telescope at C.T.I.O. The limiting magnitude for classification was approximately m/sub V/ equals 12, with completeness obtained to m/sub V/ approximately 11. The resulting luminosity function rises from log N + 10 equals 7.9 at M/sub V/ equals 8 to about 8.7 at M/sub V/ equals 11 and 12. A galactic mass density of about 0.08 solar mass /pc^3 is found for the dwarfs considered. Adding reasonable mass densities for other objects yields a total density of approximately 0.2 solar mass/pc^3. This is sufficient to account for the "missing mass". A large variation in CaH strength in these dwarfs is found and is interpreted as a significant variation in metal content. The average tangential (transverse) velocity of the dwarfs found is about 23 km/sec with a dispersion of about 13 to 15 km/sec. (Diss. Abstr. Int., B)

1591 EMISSION FROM PULSARS. I. A Generalized Single-Vector Polarization Model. II. A Model for the Subpulse and Integrated Pulse Behavior. Ferguson, D. C. Tucson, AZ; Univ. of Arizona (1974). 332p. University Microfilms Order No. 75-14,216.

Thesis (Ph. D.).

In Part I, the properties of models for pulsar polarization which incorporate localized emission regions corotating with a neutron star are investigated. The formulae applicable to the case where emission comes from near the neutron star surface are derived and compared with those applicable for emission from further out in the magnetosphere. In all the models investigated, it is assumed that the instantaneous polarization position angle is given by the apparent projection of a corotating magnetic field vector on the plane of the sky, and that the percentage of linear polarization is proportional to some power of the apparent projected length of the vector along the line of sight. Relativistic effects which become important for emission from far out in the magnetosphere are thoroughly discussed and related to the polarization behavior predicted by the models. In Part II, the pulsar observations believed important for an understanding of their physical nature are discussed. Pulsar PSR 0329 + 54 provides a detailed look at properties of a typical pulsar. It is shown that if the radiation is cyclotron or single electron synchrotron radiation then the emission frame is in rapid motion relative to the observer. Possible mechanisms for producing broad band individual pulse (sub-pulse) radiation are discussed. Also, the relativistic vector model is fit to several pulsars which represent different classes in a popular classification scheme. The Crab Nebula pulsar is discussed in detail. Finally, guidelines for possible theoretical models of the emission are presented. (Diss. Abstr. Int., B)

1592 THEORETICAL EMISSION LINE PROFILES FOR NOVAE. Bochonko, D. R. Ann Arbor, MI; Univ. of Michigan (1974). 139p. University Microfilms Order No. 75-10,135.

Thesis (Ph. D.).

This paper discusses theoretical emission line profiles that were computed for spherically symmetric, nonrotating, radially expanding models of shells ejected by novae. The theory of the formation of the emission line profile is developed using Gaussian wavelength distributions for the volume absorption and emission coefficients. The expression for the energy emission from the shell is evaluated in detail using numerical integration techniques. The behavior of the theoretical profiles is examined for changes in the following parameters: distribution through the shell of the speed of expansion; thermal broadening; and excitation conditions, specified by the distributions of the densities of absorbing and emitting atoms. An analysis is made of the regions of the shell that contribute to different parts of the profiles. The analysis of the behavior of the theoretical profiles is used to find a model to fit observations of H epsilon and [OIII], lambda 4363, of Nova Herculis 1963 on June 14, 1963. (Diss. Abstr. Int., B)

1593 DEVELOPMENT OF THE UBViyz PHOTOMETRIC SYSTEM AND ITS APPLICATION TO THE STUDY OF METAL ABUNDANCES IN GALACTIC G AND K GIANT STARS. Jennens, P. A. (Rochester, NY; Univ. of Rochester (1975)). 229p. University Microfilms Order No. 75-15,207.

Thesis (Ph. D.).

A fast photometric system, employing six filters and a photomultiplier with S-20 cathode, was selected to study G and K giant

stars. Measurements, in the new system, have been made for approximately 260 nearby giant stars and for approximately 180 giants in nineteen galactic clusters and one globular cluster, and are reported in Appendix I. The color y-z is sensitive to luminosity and is used to determine absolute visual magnitudes to a precision of approximately +-1. The calibration made using the nearby stars is applied to the cluster stars. The accuracy of the luminosity and color-excess calibration is confirmed. For the 19 galactic clusters, for which 5 x 10^7 years less than estimated age less than 8 x 10^9 years, metal abundances in the range -1.0 less than or equal to [Fe/H] less than or equal to 0.05 are determined. No obvious correlation of [Fe/H] with either cluster age or location in the galactic disc is found. (Diss. Abstr. Int., B)

1594 CORONAS WITH BREMSSTRAHLUNG COOLING. Hoffman, N. M. III. (Madison, WI; Univ. of Wisconsin (1974)). 92p. University Microfilms Order No. 75-9977.

Thesis (Ph. D.).

The aim of this work is to study the structure and observable properties of a corona which is sufficiently hot and dense that radiative cooling is a significant contributor to the energy balance. Accordingly the hydrodynamic equations for a stationary, spherically-symmetric inviscid one-fluid optically-thin stellar wind, heated by electron conduction and cooled by bremsstrahlung, are presented and solved. It is found that at sufficiently large absolute values of the gravitational potential, a region appears in which the conductive heating rate and the bremsstrahlung cooling rate are nearly in equilibrium. In this region the gas temperature T varies as r^{-1}, and the gas bulk velocity v varies as r/sup 1/2/. Analytic approximations to the solutions in this region are found, and are used to justify some of the simplifying assumptions incorporated in the model. A grid of models is computed for a star of mass 3 x 10^{32} gm and radius 10^8 cm, representative of a white dwarf. Finally the applicability of these models to the hypothetical coronas of white dwarfs is discussed. (Diss. Abstr. Int., B)

1595 EMISSION NEBULAE AT RADIO WAVELENGTHS. Terzian, Y. (Cornell Univ., Ithaca, NY). pp 279-307 of Vistas in Astronomy. Vol. XVI. New York; Pergamon Press (1974).

Radio observation of emission nebulas over a broad frequency range (10 MHz to 100 GHz) has helped to elucidate the structure of these objects, their distribution in the Galaxy, and the processes of stellar evolution. An important advantage of radio-astronomical methods is the negligible interstellar extinction at radio frequencies. The radio radiation studied from emission nebulas consists of continuum radiation (due to free-free transitions) and line radiation (due to electron recombinations and subsequent cascades to lower energy levels). The theory of these processes is discussed in detail in the present paper. Radio observations of several major H II regions are considered, including the distribution of free-free radiation and the observations of hydrogen, helium, and carbon lines. The physical parameters of the emission nebulas, including the electron densities, emission measures, electron temperatures, and total masses, can be derived from the radio observations and the calculated distances to the regions. (IAA)

1596 PHOTOMETRIC CLASSIFICATION OF THE O-B STARS. Bigay, H.; Garnier, R. (Lyon Observatoire, Rhone, France). pp 165-177 of Vistas in Astronomy. Vol. XVI. New York; Pergamon Press (1974).

The problems involved in measuring the distances of O-B stars are considered. The advantages of using a photometric two-dimensional classification of the O-B stars are discussed. The classification presented represents each star as a point plotted with respect to two coordinates; the intrinsic color index (U-B)O and the total intensity, beta, of the H-beta line, measured photoelectrically. (IAA)

1597 EARLY TYPE STARS WITH ABNORMAL SPECTRA. Jaschek, M.; Jaschek, C. (Observatorio Astronomico, La Plata). pp 131-163 of Vistas in Astronomy. Vol. XVI. New York; Pergamon Press (1974).

The review deals with the results of spectroscopic observations of early-type peculiar stars. The primary focus is on visual spectroscopy. Classification schemes which have been used for peculiar A-type (Ap) stars are discussed. The present paper considers their characteristics by classifying them into only three subdivisions; manganese stars, silicon stars, and late-type stars. The classification of metallic-line (Am) and B-type peculiar (Bp) stars is also investigated. The Bp stars are considered under the subdivisions of helium-weak, helium-rich, and nitrogen stars. The difficulty of defining meaningful groups, and, consequently, of finding stars which are representative of such groups, is emphasized. The regularities revealed by plotting the average UBV colors of the three types are discussed. (IAA)

1598 REFLECTION EFFECT IN VERY CLOSE ECLIPSING BINARY SYSTEMS WITH DISTORTED COMPONENTS. Binnendijk, L. (Flower and Cook Observatory, Philadelphia). pp 85-115 of Vistas in Astronomy. Vol. XVI. New York; Pergamon Press (1974).

The analytical formula for the reflection effect is discussed for a system with spherical components. By numerical integration the reflection is computed at phase angles of 0 and 90 degrees. The position of the photocenter at the elongations can then be compared using both approaches. A new method of computing the reflection effect by numerical integration is developed both for the rotational ellipsoids used extensively in the practical interpretation of light curves and for models used in the theory of distorted components. The surface brightness in the direction of the normal and the fractional temperature increase are given for several models. It is found that the dynamical distortion of the components tends to increase the phase function at zero phase angle but that the photometric darkening of the tidal bulge due to the gravity effect tends to decrease the phase function again. (IAA)

1599 INTRINSIC LIGHT VARIATION IN VERY CLOSE ECLIPSING BINARY SYSTEMS WITH DISTORTED COMPONENTS. Binnendijk, L. (Flower and Cook Observatory, Philadelphia). pp 61-83 of Vistas in Astronomy. Vol. XVI. New York; Pergamon Press (1974).

Using the theory of distorted components in very close binaries, the semiaxes are computed for several possible models. The coefficients of limb darkening and the gravity effect are found as weighted mean values of the results of several theoretical investigations. A simple linear relation is found between the coefficient of limb darkening and the logarithm of the effective temperature in the spectral interval A0 to K0. The Fourier series for the intrinsic light variation of such distorted components is given for any polytropic index. The influence of the tidal bulge is described in detail. (IAA)

1600 SURVEY OF SPECTROSCOPIC BINARIES. Bouigue, R. (Univ., Toulouse). pp 117-129 of Vistas in Astronomy. Vol. XVI. New York; Pergamon Press (1974).

Two results are obtained for spectroscopic binary stars: one refers to the period-eccentricity relation for contract systems, and the other concerns the distribution of stellar masses and its relevance to the problems of evolution. It is suggested that the observational data are inadequate, and that further observations would be of interest for the study of stellar evolution. (IAA)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 1516, 1533, 1580, 1660, 1661, 1665, 1691, and 2248.

1601 (AD/A-004640) VARIABLE RADIO SOURCE STRUCTURE ON A SCALE OF SEVERAL MINUTES OF ARC (1). Ross, H. N. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1975. Contract N00014-67-A-0094-0019. 31p. NTIS $3.75.

During the course of high frequency flux density measurements on sources exhibiting low frequency cutoffs, at lease three such sources 4C 79.4, 4C 79.15, 9 and PKS 2344 + 09, revealed structure on a scale ranging from a fraction of a minute of arc to as much as fifteen minutes of arc. This structure appears to change significantly on a time scale of several months. It is suggested that this variable structure arises from the existence of several centers that are highly variable in flux density, but fixed in position. (GRA)

1602 (AD/A-004641) OBSERVATIONS WITH A VLB ARRAY. I. Introduction and Procedures (15). Cohen, M. H.; Moffett, A. T.; Romney, J. D.; Schilizzi, R. T.; Shaffer, D. B. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. Contract N00014-67-A-0094-0019. 29p. NTIS $3.75.

A series of observations is described, intended to investigate the structure and the time development of the structure of compact extragalactic radio sources at lambda = 2.8 cm and resolution 0.001 second. Discussed are the 5 telescopes, the sensitivity of the system, the calibration procedures, and modeling procedures. (GRA)

1603 THE ABSORPTION SPECTRUM OF 4C 25.05. Oemler, A. Jr.; Lynds, C.R. (Kitt Peak National Observatory). Astrophys. J. 199: No. 3, 558-564 (1 Aug 1975).

The QSO 4C 25.05 (Z_{em}=2.360) has a very rich absorption spectrum, especially shortward of the Lα emission feature at 4086 A. Only one redshift system can be found which identifies enough (11 of 83) absorption lines to be considered unquestionably real. The hypothesis is considered that many of the remaining strong lines are due to Lα in absorption systems in which most of the lines of other elements are too weak to be seen. Several statistical tests involving the 83 observed absorption lines, weak absorption lines buried in the observational noise, and Lα/Lβ pairs all support this idea. Thirteen redshift systems were found which explain most of the observed absorption lines. The dependence of the equivalent width of Lβ on that of Lα in these

systems is consistent with a velocity dispersion in the absorbing clouds in the range 30–55 km s^{-1}. (auth)

1604 HIGH-FREQUENCY STRUCTURE OF 3C 154. Menon, T.K. (National Radio Astronomy Observatory, Green Bank, West Virginia). Astrophys. J. Lett. 199: No. 3, L161-L163 (1 Aug 1975).

The structure of the source 3C 154 at 2695 MHZ and 8085 MHz is compared with its structure at 327 MHz obtained with the Ooty occultation telescope. It is found that the fraction of the total flux in a central compact component of the basic triple source increases with frequency and reaches nearly 40 percent at 8085 MHz. There is some indication that the fraction in central components may be increasing in fainter triple sources. (auth)

1605 POSITIONS AND FLUX DENSITIES OF 5C 3 SOURCES NEAR M31. Spencer, J.H.; Burke, B.F. (Research Laboratory of Electronics and Department of Physics, Massachusetts Institute of Technology). Astrophys. J. 199: No. 3, 611-618 (1 Aug 1975).

Observations of selected regions in the direction of M31 provide information on the flux densities and spectral indices between 408 and 8085 MHz for six sources from the 5C 3 catalog. A total of 12 sources were detected at 2695 MHz, and upper limits on flux density and spectral index are provided for 33 undetected sources. Improved positions are given for the detected sources. Spectral indices of the detected 5C 3 sources have steep spectra, which provides an argument that the 5C 3 sources are not associated with M31. (auth)

1606 PHOTOMETRIC HISTORIES OF QSOs: TWO QSOs WITH LARGE LIGHT AMPLITUDE. Liller, M.H.; Liller, W. (Center for Astrophysics, Harvard College Observatory). Astrophys. J. Lett. 199: No. 3, L133-L135 (1 Aug 1975).

PKS 1510—089, a QSO with a redshift $z=0.361$, has varied in B from 11.8 to 17.8 mag since 1899.6. At its brightest in 1948, PKS 1510—089 was optically one of the most luminous known objects in the universe if its redshift is cosmological. Its observed range in brightness, 5.4 mag, is larger than that known for any other QSO. MA 0829+047 is a BL Lac object (i.e., a QSO with a featureless optical spectrum) which has varied in B from 14.2 to 17.8 mag since 1934.1. In one 23.8 hour period it increased in brightness by more than a factor of 2, implying a line-of-sight dimension of $\lesssim 8 \times 10^{-4}$ pc. We compare MA 0829+047 and PKS 1510—089 with other similar objects and discuss the significance of our findings. (auth)

1607 A JET IN THE GALAXY IDENTIFIED WITH THE RADIO SOURCE DA 240. Burbidge, E.M.; Smith, H.E.; Burbidge, G.R. (Department of Physics, University of California, San Diego). Astrophys. J. Lett. 199: No. 3, L137-L138 (1 Aug 1975).

The galaxy MCG 9-13-66 associated with the large radio source DA 240 has been shown to contain a large jet with a featureless spectrum somewhat bluer in color than the galaxy, oriented at 62° to the axis of radio emission. Observations made at Kitt Peak National Observatory and Lick Observatory are described. (auth)

1608 A SUDDEN INCREASE IN THE X—RAY FLUX FROM CENTAURUS A. Winkler, P.F. Jr. (Department of Physics, Middlebury College); White, A.E. Astrophys. J. Lett. 199: No. 3, L139-L142 (1 Aug 1975).

Observations from OSO-7 show that the X-ray flux from Cen A increased by a factor of at least 1.6 over a six-day period in 1973 April. Long-term observations indicate greater increases and a hardening of the spectrum. The maximum flux exceeded that measured by Tucker *et al.* and Lampton *et al.* in 1970–1971 by factors of 6.7 at 2–10 keV and 14 at 10–50 keV. Both rapid variability and a harder spectrum are consistent with a model proposed by Grindlay. At maximum brightness our best-fit spectrum leads to a 2–50 keV luminosity of 1.1×10^{43} ergs s^{-1}. (auth)

1609 X—RAY BINARIES IN GLOBULAR CLUSTERS. Clark, G.W. (Department of Physics and Center for Space Research, Massachusetts Institute of Technology). Astrophys. J. Lett. 199: No. 3, L143-L145 (1 Aug 1975).

It appears to be very unlikely that primordial binaries in globular clusters have evolved to produce high-luminosity X-ray sources like the four variable sources detected in observations by the *Uhuru* and OSO—7 satellites. Therefore, it is suggested that the cluster X-ray sources are binaries formed by capture from the remnants of massive single stars that exploded with sufficient isotropy to remain bound in the cluster. These remnants have lurked near the centers of the clusters where the high stellar densities have favored their capture of field stars which eventually turn the remnants on as X-ray source when the captives enter the post-main-sequence expansion phase of their evolution. A case is made for the conclusion that there is approximately one potential binary X-ray source near the center of each of the globular clusters. (auth)

1610 SHORT-TERM TIME VARIABILITY OF CYGNUS X—1. Weisskopf, M.C.; Kahn, S.M. (Columbia Astrophysics Laboratory, Columbia University); Sutherland, P.G. Astrophys. J. Lett. 199: No. 3, L147-L151 (1 Aug 1975).

Autocorrelation functions, power density spectra, and cross-correlation functions were calculated for 71 observations of Cyg X—1 obtained by the *Uhuru* satellite. The average autocorrelation function and power density spectrum were found to be independent of energy and consistent with a shot-noise source with a characteristic time constant of 0.45 s. The data in different energy bands were found to be 100 percent correlated. (auth)

1611 CYGNUS X—1: A TWO-TEMPERATURE ACCRETION DISK MODEL WHICH EXPLAINS THE OBSERVED HARD X—RAY SPECTRUM. Eardley, D.M. (Physics Department, Yale University); Lightman, A.P.; Shapiro, S.L. Astrophys. J. Lett. 199: No. 3, L153-L155 (1 Aug 1975).

We present a model for Cygnus X—1, involving an accretion disk around a black hole, which fits the observed X-ray spectrum from 8 to 500 keV. The hard component of the spectrum ($E > 8$ keV) is produced by an optically thin inner portion of the disk in which the electrons are 10^9 K and the ions are 3–300 times hotter. (auth)

1612 INFRARED MEASUREMENTS ON SEVERAL SOURCES IN THE DR-21 REGION. Thum, C.; Lemke, D. (Max-Planck-Inst. for Astronomy, Heidelberg). Astron. Astrophys.; 41: No. 3-4, 467-469 (Jul 1975).

2.2 and 3.5 μ measurements on DR-21 and three nearby pointlike sources are reported. A beam size effect was found on DR-21. W 75 (S)-OH was detected for the first time in the near infrared. A physical model for W 75/IRS 1 is proposed. According to it the source might be a heavily obscured B-star close to the main sequence. (auth)

1613 VARIABLE OBJECTS OF NONSTELLAR NATURE. Pskovskii, Yu. P. pp 338-369 of Nonsteady-State Phenomena and Stellar Evolution. Boiarchuk, A. A. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

Phenomena are examined which are associated with the variability of emissions from objects with extremely large masses, such as quasars, galactic nuclei, and compact nonthermal radio sources. The principal characteristics of quasars are outlined, and the optical variability of quasars, galactic nuclei, and compact objects of BL Lac type is analyzed. The variability in the radio frequency range of extragalactic sources is studied. (IAA)

1614 POSSIBLE EFFECT OF MISIDENTIFICATION OF QSOs ON THE REDSHIFT DISTRIBUTION. Basu, D. (Univ., Sao Paulo, Brazil). Astrophys. Lett.; 16: No. 2, 53-55(1975).

The emission lines of QSOs on entering the U, B, V filters may change the (U—B) and (B—V) color indices of the objects such that these indices have values similar to those of main sequence stars. Some QSOs will thus be lost due to misidentification and may account for some of the "holes" in the redshift (z) distribution. It is shown that this effect is important at $z > 0.7$. (auth)

1615 X-RAY SOURCES IN BINARY SYSTEMS. Sluniaev, R. A.; Shakura, N. I. pp 231-260 of Nonsteady-State Phenomena and Stellar Evolution. Boiarchuk, A. A. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The characteristics and peculiar features of the principal X-ray sources detected by an X-ray satellite are examined, with particular reference to X-ray sources which constitute the compact component of binary stars (the Cyg X-1 close binary and five eclipsing close binaries). It is argued that for such binary systems, accretion (deposition of matter on a compact object, accompanied by release of gravitational energy) constitutes the energy source. The characteristics of disk-type accretion on a black hole, and of accretion on neutron stars and white dwarfs are examined, along with some phenomena occurring in close X-ray binaries. (IAA)

1616 X-RAY SOURCES IN CLOSE BINARY SYSTEMS. Rees, M. J. (Cambridge Univ., Eng.). pp 89-107 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

General theoretical aspects involved in the concept of X-ray sources in close binary systems are examined, taking into account aspects of mass transfer, questions concerning the accretion disk, and details regarding the compact object and the X-ray emission. The X-ray properties of Her X1 and Cen X3 are discussed, giving attention to changes in the pulse period and the long-term variability of Her X1. It is pointed out that Cyg X1 is the prime candidate for being an X-ray source involving a black hole. Problems regarding the interpretation of the optical properties of X-ray binaries are also considered. (IAA)

1617 SEARCH FOR SOFT STELLAR X-RAY SOURCES. Vanderhill, M. J. Madison, WI; Univ. of Wisconsin (1974). 124p. University Microfilms Order No. 74-27,768.

Thesis (Ph. D.).

A sensitive soft x-ray survey of about one-tenth of the sky with the S-150 Galactic X-ray Mapping Experiment, flown as part of the Skylab program on July 28, 1973, revealed no evidence for soft x-ray emission from stellar sources. Soft x-ray emission from giant stars, binary stars, and most main sequence stars is

unable to account for the observed low energy diffuse x-ray background originates from the super-position of discrete stellar sources. But if white dwarfs and M dwarfs are as numerous as some investigators have proposed, this experiment is unable to eliminate these stars as important contributors to the diffuse x-ray background. (Diss. Abstr. Int., B)

1618 LOW-FREQUENCY SPECTRA OF COMPACT RADIO SOURCES. Resch, G. M. Tallahassee; Florida State Univ. (1974). 214p. University Microfilms Order No. 75-12,668.

Thesis (Ph. D.).

A large number of very-long-baseline experiments have been performed at centimeter and decimeter wavelengths revealing intrinsic source structure in the range 0.0001 to 0.1 arc set. At meter wavelengths the standard technique used to investigate compact source structure has been observations of their interplanetary scintillations. We began a program of low frequency (100 MHz) very-long-baseline observations in 1971 both to measure the intrinsic size of compact radio sources and to compare the directly observed sizes with those sizes inferred from scintillation techniques. We present the results of a series of very-long-baseline interferrometric experiments utilizing the 305-m antenna at Arecibo, the 92-m antenna at Greenbank and the 46-m antenna at Sugar Grove, West Virginia. This provided us with a short (approximately 50 km) baseline and two nearly equal long (approximately 2500 km) baseline which we operated at 74, 111 and 196 MHz. The respective fringe spacings at these frequencies were 15, 12, and 7 arc sec on the short baseline and 0.3, 0.2, and 0.1 arc sec on the long baseline. Typical sensitivity was approximately 2 Jy except at 74 MHz on the short baseline where confusion noise limited the usable sensitivity to approximately 4 Jy. The calibration of the experiment is discussed and it is shown that the internal consistency as well as the agreement with an independent flux density is excellent. The data are compared with flux density and source size determinations from interplanetary scintillation observations and it is argued that the size scale of the scintillation determinations is too large by some small but non-trivial factor. Finally we present the spectra and summarize the structure of a few selected radio sources. (Diss. Abstr. Int., B)

1619 NUMERICAL STUDIES OF MASS TRANSFER AND ACCRETION IN X-RAY BINARY STUDIES. Aime, M. L. Davis, CA; Univ. of California (1974). 198p. University Microfilms Order No. 75-15,418.

Thesis (Ph. D.).

Several aspects of mass transfer and accretion in X-ray binary systems are numerically investigated. Computer calculations of the X-ray emission resulting from the accretion of material onto a neutron star; the X-ray heating of the surface of HZ Her; and the X-ray heating of a gas stream leaving Hz Her through the inner Lagrangian point, falling toward Her X-1 are performed. For high mass (greater than 1.4 M/sub O/) neutron stars, the emitted spectra differ only slightly from blackbody, particularly at low luminosities. For intermediate mass neutron stars the spectra differ substantially from blackbody spectra, especially at higher luminosities. The calculated spectra differ greatly from blackbody spectra at all luminosities for low mass neutron stars. The attenuation and diffusion of a beam of X-rays incident on the surface of HZ Her is calculated. In calculations of the X-ray heating of the gas stream, it is assumed that cold material leaves HZ Her, flowing through the inner Lagrangian point. Modifications in the hydrodynamical motion due to the X-ray heating are calculated. Strong X-ray heating effects for some choices of boundary conditions can be calculated, but it cannot be determined if, in general, X-ray heating effects dominate the motion of the infalling gas. (Diss. Abstr. Int., B)

1620 PLANETARY NEBULAE AS RADIO SOURCES. Thompson, A. R. (Stanford Univ., CA). Contract F44620-68-C-0028. pp 309-328 of Vistas in Astronomy. Vol. XVI. New York; Pergamon Press (1974).

Radio observations of the planetary nebulas have strengthened most of the conclusions derived from extensive optical observations. The electron temperatures deduced from radio-continuum observations can be used to investigate radial temperature variations in the nebulas. The radio observations provide estimates of optical extinction and improved data for the derivation of distances and masses. They can also help to distinguish planetary nebulas from small high-density H II regions. (IAA)

Solar Phenomena

Refer also to abstracts 264, 1488, 1503, 1508, 1691, 1700, 1736, and 1759.

1621 (AD/A-003683) SPECTRAL CORRELATIONS BETWEEN SOLAR FLARE RADIO BURSTS AND ASSOCIATED PROTON FLUXES. I. Interim Report. Bakshi, P.; Barron, W. (Boston Coll., Chestnut Hill, Mass. (USA). Dept. of Physics). Oct 1974. Contract F19628-72-C-0003. 26p. NTIS $3.75.

The present study is directed towards establishing a correlation between certain characteristics of the radio spectrum and the relative intensities of the proton spectrum as measured by peak proton fluxes. This study essentially provides a prediction on the hardness (shallow spectrum) or softness (steep spectrum) of the proton spectrum (peak proton flux vs. energy range). (GRA)

1622 (AD/A-004069) ASTRONOMY RESEARCH AT THE AEROSPACE CORPORATION. Paulikas, G. A. (Aerospace Corp., El Segundo, Calif. (USA)). 17 Dec 1974. Contract F04701-74-C-0075. 33p. NTIS $3.75.

Sponsored in part by National Aeronautics and Space Administration, Washington, D. C.

This report reviews the astronomy research carried out at The Aerospace Corporation during 1974. The report describes the activities of the San Fernando Observatory, the research in millimeter wave radio astronomy as well as the space astronomy research. (GRA)

1623 (COM-74-50190-363-1/SL) SOLAR-GEOPHYSICAL DATA NUMBER 363, NOVEMBER 1974. Part I (Prompt Reports). Data for October 1974, September 1974. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Nov 1974. 127p. (SGD-363(Pt-1)). National Climatic Center, Asheville, NC 28801 $1.40.

Prompt reports are given on data for October 1974 and September 1974. These deal with alert periods, daily solar indices, solar flares, solar radio waves, spacecraft observations, solar proton monitoring, inferred IP magnetic field polarities, daily solar activity centers, sudden ionospheric disturbances, cosmic rays, geomagnetic indices and radio propagation indices. This issue also includes an index for 1973 and 1974. (GRA)

1624 (COM-74-50190-363-2/SL) SOLAR-GEOPHYSICAL DATA NUMBER 363, NOVEMBER 1974. Part II (Comprehensive Reports). Data for May 1974-April 1974 and Miscellanea. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Nov 1974. 51p. (SGD-363(Pt-2)). National Climatic Center, Asheville, NC 28801 $1.40.

See also COM-74-50190-363-1.

This issue provides comprehensive data for May 1974-April 1974 on solar flares, solar radio waves, magnetograms of geomagnetic storm, abbreviated calendar record, regional flare index, and ADPP Auroral photograph. It also includes miscellaneous data on neutron monitor — Thule — August 1974. (GRA)

1625 INTERPLANETARY GAS. XXI. VALIDITY OF THE CHAPMAN-ENSKOG DESCRIPTION OF THE SOLAR WIND FOR PROTONS. Price, J.C.; Brandt, J.C.; Wolff, C.L. (Laboratory for Solar Physics and Astrophysics, NASA—Goddard Space Flight Center, Greenbelt, Maryland 20771). Astrophys. J. 199: No. 3, 756-760 (1 Aug 1975).

Measured velocity distribution functions for solar-wind protons are used to estimate the validity of the Chapman-Enskog description, and it is found to be the best description presently in use. (auth)

1626 A COMPARISON OF THE MERIDIONAL FLOWS IN THE SUN'S CONVECTION ZONE, PREDICTED BY THEORIES OF THE SOLAR DYNAMO AND DIFFERENTIAL ROTATION. Durney, B.R. (National Center for Atmospheric Research, Boulder, Colorado). Astrophys. J. 199: No. 3, 761-764 (1 Aug 1975).

Recently Yoshimura has evaluated the gradient of the Sun's angular velocity ($d\Omega/dr$) necessary to give a good fit to the observed solar activity cycle. We estimate the meridional velocities in the convection zone, implied by this value of $d\omega/dr$. These meridional velocities are in good agreement with those necessary to explain the Sun's surface differential rotation. (auth)

1627 OBSERVATION OF SUBORDINATE $2p^54d$–$2p^53p$ TRANSITIONS IN NEON-LIKE IONS FROM Ca XI TO Ni XIX. Kastner, S.O.; Behring, W.E.; Cohen, L. (Laboratory for Solar Physics and Astrophysics, NASA—Goddard Space Flight Center, Greenbelt, Maryland). Astrophys. J. 199: No. 3, 777-780 (1 Aug 1975).

We report the first identification of subordinate $2p^54d$–$2p^53p$ transitions in the neon-like ions Ca XI through Ni XIV. Such transitions between excited levels have not previously been reported for ionization stages higher than Al IV, though the resonance lines are known through Zn XXI in the neon isoelectronic sequence. Measurement of the solar flux in such transitions may aid in establishing the relative importance of the several cascade processes giving rise to the observed Fe XVII resonance lines. (auth)

1628 ON THE ANISOTROPIES OF INTERPLANETARY LOW-ENERGY PROTON INTENSITIES. Pesses, M.E. (Department of Physics and Astronomy, The University of Iowa, Iowa City, Iowa 52242); Sarris, E.T. Geophys. Res. Lett. 2: No. 8, 349-352 (Aug 1975).

Anisotropic fluxes of low-energy protons deviating from the magnetic field direction by as much as 45° during periods of time that the magnetic field vector was along the sun-earth line have been observed under certain conditions of the interplanetary medium. (auth)

1629 DETERMINATION OF THE HEIGHT OF HARD X-RAY SOURCES IN THE SOLAR ATMOSPHERE BY MEASUREMENT OF PHOTOSPHERIC ALBEDO PHOTONS. Brown, J. C.; van Beek, H. F.; McClymont, A. N. (Astronomical Inst., Utrecht).

From IAU/COSPAR Symposium 68 on solar γ^-, x^-, and EUV-radiation; Buenos Aires, Argentina (11 Jun 1974).

The importance and difficulties of determining the altitude of hard X-ray sources in the solar atmosphere are discussed. It is argued that the only unambiguous means of making this measurement is by utilising the photospherically scattered component of the radiation. Specifically, it is proposed that this can be done by measurement of the angular distribution of the large patch of photospheric albedo X-rays which is shown to accompany bright point primary X-ray sources. Quantitative predictions are made of the brightness distribution of this albedo "image" and the practical feasibility of observing it is demonstrated in terms of the hard X-ray imaging spectrometer currently under development at the Space Research Laboratory in Utrecht. (auth)

1630 GENERAL DESCRIPTION OF THE SOLAR X AND γ RAY BURSTS OBSERVED ABOARD PROGNOZ II DURING AUGUST 4 AND 7, 1972 EVENTS. Meliorenskii, A. S. (Inst. de Physique Spatiale, Moscow); Pissarenko, N. F.; Shamolin, W. M.; Likin, O. B.; Talon, R.; Vedrenne, G.; Gourdon, B. Astron. Astrophys.; 41: No. 3-4, 379-384(Jul 1975).

The solar gamma radiation results discussed here were obtained during a franco-soviet experiment launched aboard a satellite with a very eccentric orbit, pointed toward the sun. Proton and gamma-ray detector data show a good time correlation between different types of solar emission particularly between gamma and X radiation for the solar events of August 4 and 7, 1972. We have therefore been able to determine the different phases of these flares by using these correlations. (auth)

1631 ANALYSIS OF SOLAR OPTICAL FLARES IN RELATION TO THEIR PEAK INTENSITIES. Das Gupta, M. K.; Mitra, R. K.; Sarkar, S. K. (Centre of Advanced Study in Radio Physics and Electronics, Calcutta). Indian J. Radio Space Phys.; 2: No. 2, 158-160(Jun 1973).

Peak intensities of 5200 optical flares reported during the period January 1968 to December 1971 were examined in relation to their (i) occurrences, (ii) durations, (iii) ratios of rise time to duration, and (iv) classifications, both area-wise and intensity-wise. Important results obtained are: (i) flares as reported by the different observatories fall under two major groups, one group confined within the percentage intensity increase range 40-100% and the other within the range 140-300%, (ii) intensity-wise flare classification in vogue does not show any direct relationship with the present system of quantitative intensity increase evaluation and (iii) majority of the flares are "impulsive" in nature. (auth)

1632 BROAD-BAND CIRCULAR POLARIZATION OF SUNSPOTS: SPECTRAL DEPENDENCE AND THEORY. Illing, R. M. E.; Landman, D. A.; Mickey, D. L. (Univ. of Hawaii, Honolulu). Astron. Astrophys.; 41: No. 2, 183-185(Jun 1975).

Observations of circular polarization in sunspots in two spectral bands are presented; the two distinct regions of polarization recognized in previous work (uniform and "speckled" spatial dependence) are shown to have different spectral dependences. A simple model is advanced which results in circular polarization of the correct magnitude. The implications of the model for the mass flow and magnetic field structure of sunspots are discussed in the light of our previous observations. (auth)

1633 METRIC QUIET SUN DURING TWO CYCLES OF ACTIVITY AND THE NATURE OF THE CORONAL HOLES. Lantos, P.; Avignon, Y. (Observatory of Meudon, France). Astron. Astrophys.; 41: No. 2, 137-142(Jun 1975).

The radio quiet sun has been studied at 169 MHz (λ = 1.77 m) from 1957 to 1970 with the Nançay interferometer. The comparison with the other UV and radio observations and with the UV models shows that the radio quiet sun corresponds to the coronal holes. The rough constancy of the brightness temperature (T_B = 750000 K) indicates that the physical conditions in the coronal holes do not vary systematically with the cycle of activity. The heating is thus local and independent, at a first approximation, of the neighboring active regions. The coronal holes appear to be the quiet coronal regions of the sun. (auth)

1634 SOLAR CYCLE VARIATION IN ENERGETIC PARTICLE EMISSIVITY OF THE SUN. Hakura, Y. (Radio Research Labs., Tokyo). pp 1-3 of International Symposium on Solar-Terrestrial Physics. Vol. I. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

The present work analyzes the solar cosmic ray, PCA, and geomagnetic data obtained during the last three solar cycles in order to clarify the solar cycle variation in the energetic particle emissivity of the sun. Plots of the variations in annual mean of Zurich sunspot numbers, number of solar proton events per year, number of relativistic proton events (GLE's), and annual mean of the 27-day autocorrelation coefficient of the summation of Kp in the years 1941 through 1973 are presented. Longitudinal distributions of the central meridian passage dates of PCA-producing flares along the 27-day rotation chart are given for three periods and the whole 19th solar cycle. Also, the number of proton events per year, the months and element number of polyplet events, and the percentage of polyplet events among all the events per year for 1954 through 1964 are tabulated. (IAA)

1635 LATITUDINAL DISTRIBUTIONS OF SOLAR OPTICAL FLARES. Rao, K. R. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil). pp 4-15 of International Symposium on Solar-Terrestrial Physics. Vol. I. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

The latitudinal distribution of solar flares show that there are more than one maximum of their occurrence in any one year. This phenomenon is envisaged as due to the continuous generation of a pulse at higher latitudes and its migration towards the equator in about 5 years. (IAA)

1636 ANALYSIS OF DIGITAL H-ALPHA SOLAR FLARE MEASUREMENTS. Argo, P. E.; Hildebrand, V. E.; Bleiweiss, M. P. (Naval Electronics Lab. Center, San Diego, CA). pp 17-26 of International Symposium on Solar-Terrestrial Physics. Vol. I. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

H-alpha data from a digital solar flare measurement system using semiautomated computer-video techniques are examined. Periodically from early 1971, two systems were run simultaneously. The measurements are consistent to within 10 per cent. Many events show area enhancements in lower brightness levels minutes before the peak brightness in the region changes, indicating an initial heating phenomenon. Our data show a good correlation with Solrad 9 and 10 soft-X-ray fluxes. There is less correlation with the harder X-ray measurements. For four subflares, we have done a detailed temporal comparison with UCSD OSO-7 hard and soft X-rays. H-alpha brightening has excellent start time correlation with the soft X-ray, the point which attains maximum brightness coincides temporally with the hard X-ray burst peak, and the H-alpha peak brightness and enhancement area remain above the pre-event levels beyond the end of the hard X-ray burst. (IAA)

1637 POLARIZATION OF SOLAR FLARE X-RAYS DUE TO THE THOMSON SCATTERING IN THE PHOTOSPHERE. Beigman, I. L. (Inst. of Physics, Moscow). pp 28-35 of International Symposium on Solar-Terrestrial Physics. Vol. I. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

Polarization of the solar flare hard X-ray due to Thomson scattering in the photosphere is discussed. The polarization degree of scattered X-rays changes from –50 per cent to 20 per cent depends on the height of the flare and on its angle distance from the visible center of the sun. The polarization degree of the total X-rays of the solar flare changes from –2 per cent to 1.7 per cent. (IAA)

1638 FOURIER ANALYSIS OF THE FIVE MINUTE OSCILLATIONS. Lynch, D. K. (Aerospace Corp., Los Angeles). Astrophys. Lett.; 16: No. 2, 77-79(1975).

The use and limitations of the Fourier transform for analyzing aperiodic signals is discussed with regard to the solar five minute oscillations. It is argued that peaks in the observational k– ω power spectra do not necessarily represent the true spectral properties of the underlying physical process which is responsible for the data. Alternative interpretations of these peaks are proposed. It is suggested that the loss of phase information in the power spectra renders them unsuitable for determining any horizontal phase propagation characteristics of the oscillations. The lack of spatial periodicity in the oscillations and loss of phase information in the observational k– ω power spectra make a comparison between these spectra and the solutions of the dispersion equation meaningless. (auth)

1639 OBSERVATIONS OF LARGE-SCALE MOVING MAGNETIC FEATURES NEAR SUNSPOTS. Michalitsanos, A. G.

(California Inst. of Tech., Pasadena); Bhatnagar, A. Astrophys. Lett.; 16: No. 2, 43-51(1975).

High time and spatial resolution magnetograms taken with a longitudinal video magnetograph show the systematic motion of large crescents and ridges of magnetic field at the outer penumbral boundary of a large complex sunspot group. Both the ridges and the crescents are resolved into knots of flux which are typically 2 arc sec to 3 arc sec in extent, and which move in unison with velocities in the range of 0.2 to 0.3 km/sec. Over a four hour period, these ridges of magnetic field, which are predominantly of opposite polarity to the parent sunspot, are observed to move over distances of from 4 arc sec to 6 arc sec, and merge with existing outlying magnetic fields. In one case, three successive magnetic ridges were observed which emerged at the penumbral boundary and moved outward. The average lag time between the emergence of the ridges was 3 hours, and it is suggested that large scale crescents or ridges of magnetic field emerge periodically at penumbral boundaries. Preliminary models of the transport of magnetic fields around sunspots are proposed. (auth)

1640 VERIFICATION OF SOLAR PATROL CALIBRATION AT 15.4 GHz. Castelli, J. P.; Guidice, D. A. (Air Force Cambridge Research Labs., Hanscom AFB, MA). Astrophys. Lett.; 16: No. 2, 71-74(1975).

The absolute flux of the sun at 15.4 GHz has been determined as 511×10^{-22} sfu for six days during August–September 1974 at the Sagamore Hill Radio Observatory, using an optimum gain horn with hot-cold calibration loads. The maximum uncertainty of this measurement, considering all possible observational and system errors was calculated to be ~4 percent. The normal patrol measurements use the moon as a calibration source and for the corresponding period provided a flux of 518 sfu. The two sets of measurements show a consistency of 1.4 percent, well within the absolute accuracy calculated for the horn-derived values. Critical comments on this and other experiments are reviewed. (auth)

1641 SOLAR FLARES. Zirin, H. (Big Bear Solar Observatory, Washington, DC). pp 1-34 of Vistas in Astronomy. Vol. XVI. New York; Pergamon Press (1974).

A review of the knowledge about solar flares which has been obtained through observations from the earth and from space by various methods is presented. High-resolution cinematography is best carried out at H-alpha wavelengths to reveal the structure, time history, and location of flares. The classification flares in H alpha according to either physical or morphological criteria is discussed. The study of flare morphology, which shows where, when, and how flares occur, is important for evaluating theories of flares. Consideration is given to studies of flares by optical spectroscopy, radio emissions, and at X-ray and XUV wavelengths. Research has shown where and possibly why flares occur, but the physics of the instability involved, of the particle acceleration, and of the heating are still not understood. (IAA)

1642 LARGE-SCALE INHOMOGENEITIES IN THE SOLAR WIND OF SOLAR ORIGIN. Gosling, J. T. (National Center for Atmospheric Research, Boulder, CO). Rev. Geophys. Space Phys.; 13: No. 3, 1053-1058(Jul 1975).

This review focuses on the following topics: solar wind streams and associated effects, temporal evolution, solar latitude effects, solar origin of streams, shock wave disturbances in the solar wind, and solar origins of shock wave disturbance in the solar wind. (BJG)

1643 COMPOSITION OF THE SOLAR WIND: PRESENT AND PAST. Hirshberg, J. (National Center for Atmospheric Research, Boulder, CO). Rev. Geophys. Space Phys.; 13: No. 3, 1059-1063(Jul 1975).

A review is presented of studies of the elemental, isotopic, and ionic composition of the solar wind. Topics covered include helium, present-day solar wind, solar wind in lunar soils, recent solar wind, and the ancient solar wind. (BJG)

1644 RELATIVISTIC SOLAR PROTONS. Duggal, S. P. (Bartol Research Foundation of the Franklin Inst.; Swarthmore, PA). Rev. Geophys. Space Phys.; 13: No. 3, 1084-1086(Jul 1975).

A review is presented of various aspects of high-energy solar protons associated with solar flares. Topics include the intensity profile and energy spectrum, anisotropy, propagation, and acceleration. (BJG)

1645 NEUTRON AND gamma RAY EMISSION FROM THE SUN. Duggal, S. P. (Bartol Research Foundation of the Franklin Inst.; Swarthmore, PA). Rev. Geophys. Space Phys.; 13: No. 3, 1086-1087(Jul 1975).

A summary of research in neutron and gamma ray emission associated with solar flares is given. The 0.5-, 2.2-, 4.4-, and 6.1-MeV lines are discussed. (BJG)

Galaxies

Refer also to abstracts 1491, 1511, 1539, 1602, 1605, 1607, and 1608.

1646 (AD/A-004642) OBSERVATIONS OF CARBON RECOMBINATION LINE EMISSION IN THE REFLECTION NEBULA M78 (16). Brown, R. L.; Knapp, G. R.; Kuiper, T. B. H.; Kuiper, E. N. R. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. Contract N00014-67-A-0094-0019. 11p. NTIS $3.25.

The C116 (alpha) and C142 (alpha) recombination lines have been detected in the reflection nebula M78. The line emission arises in a cold T approximately equal 20K CII Stromgren sphere ionized by HD38563N and S, the exciting stars of M78 that are embedded in the dark cloud L1630. The observed lines are extremely narrow, the full width at half maximum delta V < 1.3 km/s, making these the narrowest radio recombination lines yet detected. (GRA)

1647 (LBL-3940) COOLING OF INTERSTELLAR FORMALDEHYDE BY COLLISION WITH HELIUM: AN ACCURATE QUANTUM MECHANICAL CALCULATION. Garrison, B. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1975. Contract W-7405-Eng-48. 71p. Dep. NTIS $6.75. Thesis.

In order to test a collisional pumping model as a mechanism for cooling the 6 cm and 2 cm doublets of interstellar formaldehyde, a quantum mechanical scattering calculation is performed. To obtain the intermolecular interaction between $H_2CO(^1A_1)$ and $He(^1S)$ two calculations are performed, a Hartree-Fock (HF) potential surface and a configuration interaction (CI) surface. A basis set of better than "triple zeta plus polarization" quality is used to compute the HF portion of the potential energy surface. This portion is highly anisotropic and has a slight attraction arising from induction effects at intermolecular separations around 9 a.u. The HF surface is modified through a series of CI calculations. Correlation is found to have little effect in the strongly anisotropic repulsive region of the interaction potential but dominates the well and long-range regions. The maximum well depth is attained for in-plane approaches of He and lies in the range 35-40°K for arbitrary theta at center of mass separation of 7.5 a.u. The entire surface is fit to a spherical harmonic expansion to facilitate scattering applications. (auth)

1648 INFRARED PHOTOMETRIC AND SPECTROPHOTOMETRIC OBSERVATIONS OF THE GALACTIC H II REGION G29.9-0.0. Soifer, B.T. (Department of Physics, University of California, San Diego); Pipher, J.L. Astrophys. J. 199: No. 3, 663-668 (1 Aug 1975).

Spatial, photometric, and spectrophotometric observations of the compact H II region G29.9-0.0 are reported. The photometric observations indicate that the infared object agrees in position and size with the radio source. Spectrophotometry from 8–13 μ shows a broad absorption feature, as well as fine-structure emission lines of Ar^{++} and Ne^{+}. Model fits to the spectrum of G29.9-0.0 indicate that there is strong absorption throughout the 8—13 μ spectral region. The photometry indicates that dust competes with the gas for absorbing the ionizing stellar continuum, while there is evidence for a depletion of dust within the ionized region. A comparison of 2.2 μ—10 μ extinction to the source indicates that $A_v/\tau_{9.75\mu} > 6$ mag. (auth)

1649 MEASURED EXTINCTION OF SMALL OLIVINE SPHERES. Day, K.L. (Lunar and Planetary Laboratory, University of Arizona). Astrophys. J. 199: No. 3, 660-662 (1 Aug 1975).

Crystalline spheres of the silicate forsterite (Mg_2SiO_4), with a mean diameter of around 600 A, were prepared in the laboratory. Their infrared extinction in the region 1100–400 cm^{-1} was quantitatively measured and the results were compared with the work of other authors and with Mie theory calculations. The extremely sharp spikes predicted by Mie theory were not realized, though agreement with peak positions and integrated absorption strengths was good. (auth)

1650 A MICROWAVE INVESTIGATION OF THE TRIFID NEBULA AND ITS SURROUNDING ENVIRONMENT. Chaisson, E.J.; Willson, R.F. (Center for Astrophysics, Harvard College Observatory). Astrophys. J. 199: No. 3, 647-659 (1 Aug 1975).

The M20 gaseous nebula and the nearby environment in which it resides have been studied extensively at microwave wavelengths. New maps of thermal bremsstrahlung radiation are used to delineate the full extent of the ionized gas relative to the partially obscuring matter of an adjacent molecular cloud. Extensive observations of the 110α recombination-line set are combined with the continuum radio emission to estimate several bulk nebular parameters: $n_e \simeq 100$ cm^{-3}, $EM \simeq 10^{4.7}$ pc cm^{-6}, $M \simeq 210$ $M_\odot$, $L_c \simeq 10^{48.8}$ photons s^{-1}, $T_e \simeq 8150$ K, n (He)/n (H) $\simeq 0.095$, and $v_t \simeq 8.5$ km s^{-1}. The distribution of derived nebular properties in many respects shows closer agreement with what is theoretically expected of galactic nebulae than does perhaps any other H II region investigated to date by radio techniques: normal helium

abundance, subsonic turbulence, considerable symmetry about the exciting star, and T_e values that agree well with those found by optical techniques and that suggest a positive thermal gradient with nebular radius. The surrounding environment is briefly surveyed by means of 18-cm OH absorption, which is shown to peak to the west of the M20 nebula where optical obscuration is strongest. A more comprehensive exploration of the nearby region via the 6-cm H_2CO line reveals an extended molecular cloud engulfing the nebula from the south and west. Enclosed within this large cloud is a molecular concentration of considerable mass ($\gtrsim 1300\ M_\odot$) and density ($\gtrsim 400\ cm^{-3}$), coincident with a globule of total obscuration, whose kinematic properties strongly suggest gravitational collapse. Observational evidence for the possible interaction of the ionized nebular gas with the surrounding molecular region, including the possibility that the apparent collapse has been triggered by the enhanced density associated with a nebular shock front, is discussed briefly. An empirical model for the evolution of an interstellar cloud, from a quiescent to a collapsing to a nebular phase, is proposed and discussed. (auth)

1651 CHARGE TRANSFER REACTIONS IN MULTIPLY CHARGED ION-ATOM COLLISIONS. Steigman, G. (Yale University Observatory). Astrophys. J. 199: No. 3, 642-646 (1 Aug 1975).

Charge transfer reactions in collisions between highly charged ions and neutral atoms of hydrogen and/or helium may be rapid at thermal energies. If these reactions are rapid, they will suppress highly charged ions in H I regions and guarantee that the observed absorption features from such ions cannot originate in the interstellar gas. A discussion of such charge transfer reactions is presented and compared with the available experimental data. The possible implications of these reactions for observations of the interstellar medium, H II regions, and planetary nebulae are outlined. (auth)

1652 ANGULAR DISTRIBUTIONS IN THE ELASTIC SCATTERING AND ROTATIONAL EXCITATION OF MOLECULAR HYDROGEN BY ATOMIC HYDROGEN. Chu, S.; Dalgarno, A. (Center for Astrophysics, Harvard College Observatory). Astrophys. J. 199: No. 3, 637-641 (1 Aug 1975).

The effective close-coupling method of Rabitz is tested and used to calculate the angular distributions of the elastic and inelastic scattering of molecular hydrogen in collision with atomic hydrogen when rotational transitions may occur. The interaction potential adopted is the Porter-Karplus semi-empirical potential surface, which was joined smoothly to the correct long-range potentials. Explicit calculations are reported for the differential elastic and total inelastic cross sections in the energy range from 0.1 to 1.5 eV. (auth)

1653 THE FORMATION OF CH^+ IN INTERSTELLAR CLOUDS. Black, J.H.; Dalgarno, A.; Oppenheimer, M. (Center for Astrophysics, Harvard College Observatory). Astrophys. J. 199: No. 3, 633-636 (1 Aug 1975).

It is suggested that the production of CH^+ in interstellar clouds occurs by a chemical scheme initiated by the radiative association of C^+ and H_2. The scheme leads to CH_2^+ and CH_3^+ which are photodissociated to give CH^+. In contrast to previous formation mechanisms, it is not necessary to suppose that the dissociative recombination of CH^+ is anomalously slow. The same chemical sequence is also able to produce CH in harmony with the measured abundances. (auth)

1654 EVOLUTION OF ROTATING INTERSTELLAR CLOUDS. I. NUMERICAL TECHNIQUES. Black, D.C. (Space Science Division, Ames Research Center, NASA, Moffett Field, California); Bodenheimer, P. Astrophys. J. 199: No. 3, 619-632 (1 Aug 1975).

A method is described for the numerical calculation of the hydrodynamic evolution of a self-gravitating configuration, in two space dimensions with assumed axial symmetry. The calculation is formulated in cylindrical coordinates with respect to a moving Eulerian grid, and is solved using explicit hydrodynamics combined with implicit radiative transfer. The physics included is appropriate for calculation of the collapse of a rotating protostellar cloud. The gravitational field is obtained by means of an alternating-direction iterative technique. Numerical tests to demonstrate the correctness of the method are presented for special cases. (auth)

1655 SPECTROPHOTOMETRIC OBSERVATIONS OF IONIZED HYDROGEN REGIONS IN NEARBY SPIRAL AND IRREGULAR GALAXIES. Smith, H.E. (Astronomy Department, University of California, Berkeley). Astrophys. J. 199: No. 3, 591-610 (1 Aug 1975).

A program of direct photography and spectrophotometry has been carried out on H II regions in a selection of nearby spiral and irregular galaxies. Abundance analyses for H II regions in M101 and M33 show a strong radial gradient in the O/H ratio, decreasing by approximately a factor of 10 across the galaxy disks. The Ne/O and S/O abundance ratios are constant. The derived nitrogen abundances, coupled with the line ratios for other H II regions, indicate a weak gradient in the ratio of N/O, decreasing by about a factor of 4 from the nuclear regions outward. No large helium abundance differences are observed, although the most oxgyen-poor regions may show marginally significant helium deficiencies. Excitation differences among the H II regions of Sbc-Scd-Irr galaxies can best be understood in terms of an abundance sequence which progresses from higher to lower heavy-element enrichment as one progresses from the earlier to later type galaxies. (auth)

1656 THE ROTATION CURVE OF NGC 3115. Williams, T.B. (Hale Observatories, California Institute of Technology, Carnegie Institution of Washington). Astrophys. J. 199: No. 3, 586-590 (1 Aug 1975).

A rotation curve is derived for the S0 galaxy NGC 3115 from its absorption-line spectrum. The central velocity is 728 ± 9 km s^{-1}. The rotation curve rises to 260 km s^{-1} at 25 from the nucleus, and remains constant at that value to the limit of the measurements. A rough computation of the mass gives $2.4 \times 10^{10}\ M_\odot$ out to 3.4 kpc, and a mass-to-light ratio of 20 to the same radius. (auth)

1657 OBSERVATIONS OF 1-MILLIMETER CONTINUUM RADIATION FROM THE DR 21 REGION. Werner, M.W.; Elias, J.H.; Gezari, D.Y.; Hauser, M.G.; Westbrook, W.E. Astrophys. J. Lett. 199: No. 3, L185-L187 (1 Aug 1975).

Continuum emission at 1 mm has been mapped with 1′ resolution over a $3' \times 8'$ area including the compact H II region DR 21, the maser source W75(S)–OH, and the central portions of the surrounding molecular cloud. Peaks in the 1-mm intensity are observed at the positions of DR 21 and W75(S)–OH, and are roughly coincident with less marked peaks in the intensity of HCN and CO emission. An extended component of 1-mm emission is present as well. The principal source of 1-mm radiation is thought to be thermal emission from dust within the molecular gas. The characteristics of this radiation which make it a promising tool for the study of molecular clouds are briefly discussed. (auth)

1658 SPECTROPHOTOMETRY OF CRL 2688 FROM 2 TO 24 MICRONS. Forrest, W.J.; Merrill, K.M.; Russell, R.W.; Soifer, B.T. (Department of Physics, University of California, San Diego). Astrophys. J. Lett. 199: No. 3, L181-L183 (1 Aug 1975).

Medium-resolution spectrophotometry ($\Delta\lambda/\lambda \simeq 0.01$) of CRL 2688 from 2 μ to 24 μ are reported. No significant features are found from 3 μ to 24 μ, although the spectral flux distribution is broader than that of a single-temperature blackbody. (auth)

1659 A HIGH-RESOLUTION MAP OF THE W3 REGION AT FAR-INFRARED WAVELENGTHS. Fazio, G.G.; Kleinmann, D.E.; Noyes, R.W.; Wright, E.L.; Zeilik, M. II (Center for Astrophysics, Harvard College Observatory); Low, F.J. Astrophys. J. Lett. 199: No. 3, L177-L179 (1 Aug 1975).

We have mapped the area in the vicinity of the H —— region W3 at an effective wavelength of 69 μ, with high angular resolution (1′), using the 102-cm balloon-borne telescope. The main continuum source, W3, shows a partially resolved, complex structure with a FWHM size of 1′.8. The radio sources W3(OH) and G133.8+1.4 are observed, as well as three faint sources not associated with known radio emission. (auth)

1660 ISOPHOTAL TRACINGS OF GALAXIES NEAR QUASARS. Arp, H. (Hale Observatories, Carnegie Institution of Washington, California Institute of Technology); Pratt, N.M.; Sulentic, J.W. Astrophys. J. 199: No. 3, 565-585 (1 Aug 1975).

Three cases where quasars fall close to large galaxies on the plane of the sky are investigated. In all three cases, disturbances in the inner isophotes of the galaxies are found. In all cases the isophotal disturbances are extended fairly closely in the direction of the quasar and could be interpreted as due to an event that occurred in the galaxy at a time of the order of 10^7 years previously. (auth)

1661 CLUSTERS OF GALAXIES WITHIN X-RAY ERROR BOXES IN THE SOUTHERN SKY. Vidal, N. V. (Australian National Univ., Canberra). Publ. Astron. Soc. Pac.; 87: No. 518, 625-633(Aug 1974).

A photographic survey of high galactic latitudes and southern x-ray error boxes revealed five possible identifications of x-ray sources with clusters of galaxies. Spectra of galaxies taken in these clusters yielded distances and x-ray luminosities. (auth)

1662 cD GALAXIES IN POOR CLUSTERS. Morgan, W.W.; Kayser, S.; White, R.A. (Yerkes Observatory, University of Chicago). Astrophys. J. 199: No. 3, 545-548 (1 Aug 1975).

An investigation has been made to determine whether the supergiant cD galaxies, which are at present only known in rich galaxy clusters, are also present in galaxy clusterings poorer than those of the Abell catalog. A search was carried out over 73 fields of the National Geographic Society-Palomar Observatory Sky Survey; the fields were located in galactic latitudes greater than +30°. Eight clusters were found which probably contain galaxies of the cD type. While it will be necessary to obtain redshifts before cluster membership is definitely established, it seems likely that cD galaxies do occur in some poor clusters. (auth)

1663 EMPIRICAL PROPERTIES OF THE MASS DISCREPANCY IN GROUPS AND CLUSTERS OF GALAXIES. VI. PROJECTION EFFECTS. Rood, H.J. (Department of Astronomy and

Astrophysics, Michigan State University, East Lansing). Astrophys. J. 199: No. 3, 549-554 (1 Aug 1975).

Study of a hypothetical sample of identical double galaxies with circular orbits and randomly distributed relative velocity and separation vectors indicates that the empirical $(M_{tl}/M, V)$-, $(M_{tl}/M,R)$-, and (V, R) -relations for double galaxies are almost certainly caused by projection effects. Dynamical properties of loose groups of galaxies and spectroscopic double stars are discussed. (auth)

1664 ON GALACTIC ROTATION AND THE INTERGALACTIC MEDIUM. Cowsik, R.; Lerche, I. (Max-Planck-Institut für Physik und Astrophysik, Institut für extraterrestrische Physik, 8046 Garching, W. Germany). Astrophys. J. 199: No. 3, 555-557 (1 Aug 1975).

The observed spectrum of the isotropic diffuse X-ray background has often been invoked to infer the possible existence of a hot intergalactic medium at a density of the order of that required for closure of the Universe. We consider here the effect of such a hot isotropic gas on the rotation of galaxies, with the coupling between the intergalactic medium and the galaxies being provided by galactic magnetic fields. The calculation provides the basis for an indirect observational test which bears on the existence of the hot intergalactic medium. We point out that the basic physics involved should also pertain to variable X-ray stars emitting by mass accretion and, perhaps, to the Coma cluster of galaxies. (auth)

1665 PHOTON EMISSION FROM SUPRATHERMAL HELIUM IONS IN A PARTIALLY IONIZED HYDROGEN GAS. Mergenthaler, J.L. (Department of Physics, Bowling Green State University, Bowling Green, Ohio). Astrophys. J. 199: No. 3, 770-776 (1 Aug 1975).

The relative intensity and profiles of He I λ5876, He II λ4686, and He II λ3203 have been calculated using a suprathermal-ion model for broad emission lines in Seyfert galaxies and quasars. With the results of this calculation it may be possible to explain the observed helium line strengths in 3C 120, NGC 4151, NGC 7469, and 14329A. (auth)

1666 RADIAL VELOCITIES AND NEUTRAL HYDROGEN CONTENT OF THE TAILS OF THE INTERACTING GALAXIES NGC 4038/39. Huchtmeier, W. K.; Bohnenstengel, H. D. (Hamburg Observatory). Astron. Astrophys.; 41: No. 3-4, 477-479 (Jul 1975).

Neutral hydrogen has been observed in the double galaxy NGC 4038/39 (Arp 244). A considerable amount of neutral hydrogen was found along the two arms (antennas). The observed radial velocities strongly support the view that the antennas are part of the double system. More than a third of all H I is connected with the tails, i.e., 1.2×10^9 $M_\odot$ out of a total of 2.8×10^9 $M_\odot$ (for an adopted distance of 14 Mpc). (auth)

1667 UBV-PHOTOMETRY OF THREE FIELDS IN CYGNUS. Hartl, H. (Univ., Innsbruck). Astron. Astrophys.; 41: No. 3-4, 321-327(Jul 1975).

1682 stars in three fields in Cygnus ($l = 90°$, $b = -1°$) with a total area of 1 square degree were measured from Asiago Schmidt UBV-plates. One of the fields showed large and varying absorption and did not give results that could be discussed in detail. The other two give an interstellar absorption that consists of two absorption shields, one at about 450 pc distance, the other one beginning between 4 and 5 kpc distance. They can probably be identified with the Orion and the Perseus spiral arm. Star densities decrease monotonically with increasing distance, except for intrinsically bright stars which show a second maximum at about 5 kpc. The luminosity functions for the distance intervals 0.2–1.4 kpc and 1.4–2.6 kpc have the same slope as the one for the solar neighbourhood but the more distant one has lower values. Similar to Becker and Fang (1972), who made their investigations using the RGU system, we find two types of late giants with different intrinsic colors. (auth)

1668 CHARGE DISTRIBUTION OF INTERSTELLAR DUST GRAINS. Gail, H. P.; Sedlmayer, E. (Univ., Heidelberg). Astron. Astrophys.; 41: No. 3-4, 359-366(Jul 1975).

Spitzer's method to calculate the charge of interstellar dust grains is extended to the case of an ensemble of dust particles. It is shown that the members of the ensemble do not possess a unique charge but show some distribution of the particles over the different possible charge states. The resulting equilibrium charge distribution due to collisions with charged particles and irradiation by photons is derived for different models. In the region of weak charges, significant differences between the mean charge of the particles and the charge predicted by Spitzer's theory occur. Numerical results are presented for dust grains imbedded into a H I-region. For non equilibrium problems the time of relaxation towards equilibrium is derived. (auth)

1669 RADIAL VELOCITIES OF COMPACT GALAXIES IN PAIRS. Karachentsev, I. D. (Special Astrophysical Observatory, Moscow); Pronik, V. I.; Chuvaev, K. K. Astron. Astrophys.; 41: No. 3-4, 375-377(Jul 1975).

Spectral observations of 80 compact galaxies in pairs have been carried out. In 48 of them, emission lines were found and radial velocities were measured. For 18 pairs, orbital masses were determined assuming that the galaxies have circular orbits. The mean mass-to-luminosity ratio for them is $\langle f \rangle = (20.6 \pm 5.4) f_\odot$. (auth)

1670 STUDY OF THE INTERSTELLAR GAS BETWEEN THE SUN AND THE SAGITTARIUS ARM. Rickard, J. J. (European Southern Observatory, Santiago de Chile). Astron. Astrophys.; 41: No. 3-4, 403-408(Jul 1975).

The velocity field of the interstellar gas is examined in the galactic longitude interval $345° < l < 28°$ by means of Ca II K lines in high dispersion spectra. The radial velocities of the K lines are compared with 21-cm self-absorption velocities in both dark clouds (Knapp, 1972) and the extended feature mapped by Riegel and Crutcher (1972). Evidence is presented to show that the extended +7km/s feature is more distant than 500 pc. Two current hypotheses about the structure of the local gas near the sun, one based upon a ring of expanding matter, the other being a linear density-wave perturbation, are compared with the observations. The expanding ring model is in better agreement with the observed K-line velocities. (auth)

1671 THERMOIONIC EMISSION FROM HOT GRAINS. Lefevre, J. (Observatoire de Nice). Astron. Astrophys.; 41: No. 3-4, 437-440(Jul 1975).

The thermoionic emission from grains heated to a high temperature in the vicinity of stars should be taken into account in the calculation of equilibrium charge. It is always negligible for graphite grains if the star temperature exceeds 14000°K but it is important in the vicinity of cold stars. The potential of graphite grains is calculated in the solar corona. (auth)

1672 ORIGIN OF SO GALAXIES. Biermann, P. (Univ. Goettingen, Ger.); Tinsley, B. M. Astron. Astrophys.; 41: No. 3-4, 441-446(Jul 1975).

We discuss the hypothesis that SO galaxies are former spirals, in which star formation has been cut off by loss of gas. Observed UBV colors, compiled from the literature, are compared with those of model galaxies; they are consistent with the cutoff hypothesis, with the reddest SO's having ceased star formation at a very early epoch, and the bluest having made stars up to 1 or 2 10^9 years ago. The mass of gas that has been shed by evolving stars, between the cutoff epoch and now, is estimated. This is greater than the upper limits observed for H I, implying that there is some continuing mechanism for ridding SO galaxies of their gas. Several mechanisms for cutting off star formation are mentioned, and it is suggested that galaxies classified as SO may have had a variety of origins. (auth)

1673 CONCERNING THE NATURE OF THE NEBULA V–V 1-7 SURROUNDING BD–18°1967. Kohoutek, L.; Wehmeyer, R. (Hamburg Observatory, Bergedorf, Ger.). Astron. Astrophys.; 41: No. 3-4, 451-453(Jul 1975).

BD–18°1967 has been identified as a normal A 0–1 V star of $M_{bol} = +1.0$, at a distance of 213 pc, and with a rather high velocity of $v_r = +73.4$ km/s. Although the nebula V–V 1–7 is very probably associated with the star, it should not be regarded as a planetary nebula; a reflection type of the nebula is most probable. (auth)

1674 ABSENCE OF THE 4400 A DIFFUSE EMISSION FEATURE. Danks, A. C.; Lambert, D. L. (Univ. of Texas, Austin). Astron. Astrophys.; 41: No. 3-4, 455-457(Jul 1975).

New spectroscopic observations of 7 stars which exhibit the 4430 Å diffuse interstellar line are presented. A previously reported emission wing at 4400 Å is not confirmed. An alternative mechanism to grains for the production of the 4430 feature is proposed. (auth)

1675 MOLECULAR OBSERVATIONS OF THE SHARPLESS H II REGION S 228. Lucas, R.; Encrenaz, P. J. (Observatoire de Meudon, France). Astron. Astrophys.; 41: No. 2, 233-235 (Jun 1975).

Carbon monoxide and formaldehyde observations of the Sharpless H II region S 228 are presented. A cold ($T \sim 10$K) molecular cloud of density $n_{H_2} \sim 350$ cm^{-3} and mass $M \sim 2000$ $M_\odot$ has been mapped next to this H II region, which itself coincides with a higher density and hotter region. A CO profile in the direction of S 288 is also presented. (auth)

1676 INTERSTELLAR GAS TO DUST RATIO IN THE LARGE MAGELLANIC CLOUD. Isserstedt, J.; Schmidt-Kaler, T. (Ruhr-Univ., Bochum, Ger.). Astron. Astrophys.; 41: No. 2, 241-243(Jun 1975).

The gas to dust ratio in the Large Magellanic Cloud (LMC) has been investigated using newly determined reddening values

of supergiants from the catalogues of Ardeberg et al. (1972), Brunet et al. (1973) and Isserstedt (1975a). When the ratio is found from the neutral hydrogen intensity N_{HI} (summed up over the line of sight) in the neighborhood of LMC stars, less reddened supergiants in the foreground of massive H I concentrations will lead to an overestimate. On the other hand, when the ratio is found by determining the mean reddening of stars between two isophotes of integrated H I brightness the observational selection of the brighter stars leads to the same tendency. The correct value of the gas-to-dust ratio can only be found when selection effects are avoided, i.e., by restriction to the highest reddenings $E_{B-V} > 0.4$m, or to stars with absorption-corrected apparent magnitudes $V_0 < 10.0$ m and regions with $N_{HI} < 5 \cdot 10^{21}$ cm^{-2}. The resulting value $N_{HI}/E_{B-V} = 6 \cdot 10^{21}$ cm^{-2} mag^{-1} is in excellent agreement with those derived in our Galaxy. (auth)

1677 CARINA NEBULA AT 3.4 AND 6 CM. Huchtmeier, W. J. (Hamburger Sternwarte, Ger.); Day, G. A. Astron. Astrophys.; 41: No. 2, 153-164(Jun 1975).

The Carina Nebula has been mapped at 3.4 cm with the 64 m Parkes radio telescope. At this wavelength the half power beamwidth is 2.6 arcmin. Radio recombination line observations of the nebula have been obtained at 6 and 3.4 cm (H 109α and H 90α). In the vicinity of Carina II double line profiles with a separation of ~45 km s^{-1} are seen. These are interpreted in terms of an expanding sphere of ionized hydrogen. Carina I shows single profiles. The mean radial velocity of the observed lines is approximately constant over the whole nebula. Centered on the expanding region are two young galactic clusters: Trümpler 14 and Trümpler 16. It is suggested that they are responsible for the observed expansion. (auth)

1678 ANISOTROPIC REDSHIFT DISTRIBUTION FOR COMPACT GALAXIES WITH ABSORPTION SPECTRA. Jaakkola, T. (Helsinki Univ.); Karoji, H.; Moles, M.; Vigier, J. P. Nature (London); 256: No. 5512, 24-25(3 Jul 1975).

It has been found that in one hemisphere of the sky Scl galaxies have a mean velocity larger than in the other hemispheres. Similar anisotropies have also been found for bright cluster galaxies, supernovae, and Markarian galaxies. Analogous results are here reported for absorption line compact galaxies. It was found that these galaxies show a significant red shift anisotropy. (UK)

1679 SPACE DISTRIBUTION AND MOTION OF THE LOCAL H I GAS. Weaver, H. (Univ. of California, Berkeley). pp 423-440 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

The spatial distribution and kinematics of the local H I gas are studied in order to elucidate properties of local young stars and their formation processes. The observed Gould's Belt gas structure is explained as the result of two streams of descending gas, one from above and one from below the galactic plane, which collide as they flow onto the plane. The collision of the gas streams compresses the gas and promotes the formation of clouds, with subsequent gravitational collapse to form stars. (IAA)

1680 DYNAMICS AND CLUSTERS OF GALAXIES. Saari, D. G. (Northwestern Univ., Evanston, IL). pp 273-284 of Stability of the Solar System and of Small Stellar Systems. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From symposium on stability of the solar system and of small stellar systems; Warsaw, Poland (5 Sep 1973).

Under the assumption that the inverse square central force law is a good approximation to the gravitational force, at least for large distances, the different possibilities for the evolution of the Universe are sketched. Several of the possibilities lead naturally to a dynamical classification of clusters of galaxies in an expanding universe. In one of the classifications the galaxies must define configurations which are functions of the masses. The virial theorem approach of determining masses of galaxies in a cluster is briefly examined. Some tentative statements concerning a dynamical explanation of the local hypothesis for quasars are advanced. Finally, the role of mathematical probability in predicting the behavior of the Universe is discussed. (IAA)

1681 ABSENCE OF INTERSTELLAR RING MOLECULES. Fertel, J. H.; Turner, B. E. Astrophys. Lett.; 16: No. 2, 61-64(1975).

We have searched unsuccessfully for several benzene derivatives and one 4-membered ring molecule. It is argued that a relative under-abundance of such ring molecules compared to non-ring molecules is consistent with the formation of interstellar molecules by gas-phase ion–molecule reactions, and may be inconsistent with their formation on the surfaces of interstellar grains. (auth)

1682 PHYSICS OF THE INTERSTELLAR MATTER. Field, G. B. (Smithsonian Astrophysical Observatory and Harvard College Observatory, Cambridge, MA). pp 37-49 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

Observational findings regarding interstellar matter are evaluated, taking into account data obtained with the aid of the Orbiting Astronomical Observatory-3. The characteristics of interstellar dust are considered along with questions regarding the depletion of gas-phase elements, the interaction of gas and dust, and problems concerning the origin of interstellar molecules. It is suggested that cores of instellar dust grains, which are made in and ejected from cool stars, determine the chemical nature of the interstellar medium. Attention is given to a hypothetical core of silicates and iron surrounded by a mantle of ice. (IAA)

1683 GALAXY ANGULAR MOMENTUM. Thompson, L. A. Tucson, AZ; Univ. of Arizona (1974). 197p. University Microfilms Order No. 75-14,212.

Thesis (Ph. D.).

In order to test the theories which purport to explain the origin of galaxy angular momentum, this study presents new data for about 1000 individual galaxies in eight rich clusters. The clusters which are studied include Virgo, A 119, A 400, A 1656 (Coma), A 2147, A 2151 (Hercules), A 2197, and A 2199. Selected samples of these data are used to investigate systematic alignment effects in clusters of galaxies and to investigate the intrinsic ellipticities of E, SO, and spiral galaxies. The following new results are reported: Galaxies in the cluster A 2197 show a significant alignment effect (chi^2 probability less than 0.0002), and the preferential direction of alignment corresponds approximately to the major axis of the overall cluster elongation. None of the other seven clusters show any significant alignment trends. The spiral galaxy samples in four clusters (Virgo, A 1656, A 2151, and A 2197) were large enough to analyze the number distributions of forward and reverse winding spirals. Large and small spiral galaxies have identical ellipticity distributions. Large E and SO galaxies tend to be more spherical, and small E and SO galaxies more flattened. The intrinsic ellipticities of E, SO, and spiral galaxies are the same for galaxies in the "field" and for galaxies in rich clusters. Six models of galaxy formation are reviewed, and the major emphasis is placed on how each model explains the origin of galaxy angular momentum. (Diss. Abstr. Int., B)

1684 WAVELENGTH DEPENDENCE OF INTERSTELLAR POLARIZATION. Mavko, G. E. Troy, NY; Rensselaer Polytechnic Inst. (1974). 94p. University Microfilms Order No. 75-5389.

Thesis (Ph. D.).

The wavelength dependence of interstellar polarization was measured for twelve stars in three regions of the Milky Way. A 120A bandpass was used to measure the polarization at a maximum of sixteen wavelengths evenly spaced between 2.78 mu^{-1} (3600A) and 1.28 mu^{-1} (7800A). For such a wide wavelength range, the wavelength resolution is superior to that of any previously reported polarization measurements. The new scanning polarimeter built by W. A. Hiltner of the University of Michigan was used for the observations. Very broad structure was found in the wavelength dependence of the polarization. Extensive investigations were carried out to show that the structure was not caused by instrumental effects. The broad structure observed is shown to be in agreement with concurrent extinction measurements for the same stars. Also, the observed structure is of the type predicted when a homogeneous silicate grain model is fitted to the observed extinction. The results are in agreement with the hypothesis that the very broad band structure seen in the extinction is produced by the grains. (Diss. Abstr. Int., B)

1685 VERY BROADBAND STRUCTURE IN THE INTERSTELLAR EXTINCTION CURVE. Rex, K. H. Troy, NY; Rensselaer Polytechnic Inst. (1974). 111p.

Thesis (Ph. D.).

The interstellar reddening curve has been measured from 3860A to 10,240A for 16 stars with the KPNO scanning spectrometer. The existence of shallow very broadband structure (VBS) found in the data of J. B. Whiteoak has been confirmed. Higher photometric accuracy and wavelength resolution than previously obtained have better defined the known VBS and have uncovered an additional absorption structure. This new structure is about 750A wide and is centered at 1.59 mu m^{-1}(6290A). The results are displayed in terms of residuals formed by subtracting a smooth theoretical curve from the observed data. A significant regional dependence of the VBS has also been found. (Diss. Abstr. Int., B)

1686 MAP OF DIFFUSE LOW ENERGY X-RAYS FROM THE GENERAL DIRECTION OF THE GALACTIC ANTI-CENTER. Williamson, F. O. Madison, WI; Univ. of Wisconsin (1974). 104p. University Microfilms Order No. 74-28,835.

Thesis (Ph. D.).

An Aerobee 170 sounding rocket was flown from White Sands on February 18, 1972 and scanned the region bounded by 180° less than or equal to l/sup II/ less than or equal to 280° and 0° less than or equal to b/sup II/ less than or equal to 30°. A complete map of the emission from this region in the energy range .1 less than or equal to E less than or equal to .284 keV was obtained with approximately 6° x 6° resolution and 10 percent statistics. A region of enhanced emission bounded by 190° less than or equal to l/sup II/ less than or equal to 215° and 0° less than or equal to b/sup II/ less than or equal to 20° and a region of decreased emission bounded by 240° less than or equal to l/sup II/ less than or equal to 260° and 0° less than or equal to b/sup II/ less than or equal to 20° are suggested by the map. The region of enhanced emission has been previously observed in less detail by this and other groups. These features can not be related in a simple way to interstellar absorption nor can the absolute intensity be accounted for by well known diffuse mechanisms for the production of x-rays. (Diss. Abstr. Int., B)

Cosmology

Refer also to abstracts 1488 and 1976.

1687 PERSPECTIVE OF A FINITE AND DISCRETE UNIVERSE. Thyssen-Bornemisza, S.; Grayson, H. W. Pure Appl. Geophys.; 112: No. 2, 257-264(1974).

The anomalies in relativistic theory resulting from the infinities present in Riemannian geometry as used by Einstein are discussed and a better solution proposed by introducing a discrete and indivisible time unit. In considering the approach of nonsimultaneity, all infinities are assumed eliminated in this universe. To fully develop the geodesic of a four-dimensional universe the perspective of discreteness seems a basic requirement. (auth)

1688 STATE OF SUPERDENSE MATTER. Kurdgelaidze, D. F.; Maksyukov, N. I. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Optiko-Fizicheskikh Izmerenij, Moscow (USSR)). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 8, 129-133(Aug 1974). (In Russian).

For English translation see the journal Sov. Phys. J.

A study is made of the equation of state for a superdense, degenerate Fermi-gas within the framework of an expanded, 7-dimensional phase space. An analysis is made of this equation of state and of the velocity of sound. A curve of equilibrium configurations is given for superdense astronomical objects with this equation of state and also the threshold for generation of baryons and their resonances being taken into account within the framework of this formalism. (tr-SJR).

1689 TO THE STATE OF SUPERDENSE CONFIGURATIONS. Kurdgelaidze, D. F. (Moskovskij Gosudarstvennyj Univ. (USSR)). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 8, 25-30(Aug 1974). (In Russian).

For English translation see the journal Sov. Phys. J.

In the process of the gravitational compression of superdense astronomical objects the rest mass of the constituent particles of the object is a variable, and along with other parameters of the systems is determined by the equilibrium condition. A theory of similar systems should start from a symmetry of the form: $E^2 - p_1^2 - p_2^2 - p_3^2 - m = 0$, $p_4 - m$, $c = h = 1$. According to the same principle the dimensionality of the phase space should expand from 6-dimensional to 7-dimensional. The study determines the main thermodynamic quantities of an equilibrium system in 7-dimensional phase space, and considers a number of examples of their application. The equations of state of a degenerate Fermi gas in 7-dimensional phase state are determined as a separate problem of the statistical theory of the multiple degeneracy of particles. It is shown that the fluctuations of the thermodynamic quantities in this system are large $\Delta A/A \sim 1$. The problem of gravitational condensation in an expanding Friedman world is discussed. (tr-SJR).

1690 TWO-DETECTOR-COINCIDENCE SEARCH FOR BURSTS OF GRAVITATIONAL RADIATION. Douglass, D.H.; Gram, R.Q. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627); Tyson, J.A.; Lee, R.W. Phys. Rev. Lett. 35: No. 8, 480-483 (25 Aug 1975).

We have made a high-sensitivity search with two calibrated detectors in coincidence for bursts of gravitational radiation at 710 Hz of duration <0.1 sec. We find less than one event per day at a flux of 2×10^7 ergs cm^{-2} Hz^{-1}. (auth)

1691 A CONFIRMATION OF EINSTEIN'S GENERAL THEORY OF RELATIVITY BY MEASURING THE BENDING OF MICROWAVE RADIATION IN THE GRAVITATIONAL FIELD OF THE SUN. Fomalont, E.B.; Sramek, R.A. (National Radio Astronomy Observatory, Green Bank, West Virginia). Astrophys. J. 199: No. 3, 749-755 (1 Aug 1975).

An experiment to determine the relative bending of microwave radiation from three radio sources (0116+08, 0119+11, and 0111+02) as they passed near the Sun was performed with a radio interferometer of baseline 35 km in 1974 March and April. The measured bending in terms of that at the solar limb is $1''.775\pm0''.019$ (standard error), or 1.015 ± 0.011 times the Einstein prediction of general relativity. The result is not consistent with the scalar-tensor formulation of general relativity with a scalar-coupling constant $\omega<23$. (auth)

1692 CLOSED-FORM SOLUTIONS FOR THE EVOLUTION OF DENSITY PERTURBATIONS IN SOME COSMOLOGICAL MODELS. Groth, E. J.; Peebles, P. J. E. (Princeton Univ., NJ). Astron. Astrophys.; 41: No. 2, 143-145(Jun 1975).

We present closed-form solutions for the evolution of linear density perturbations (a) in a cosmological model where pressure can be neglected and $\Lambda = 0$; and (b) in a cosmologically flat model containing non-interacting matter and radiation, with $\Lambda = 0$ and the characteristic size of the irregularities much smaller than ct. (auth)

1693 CURVES GIVING THE AGE OF THE UNIVERSE IN FRIEDMANN MODELS. Campusano, L. (Observatoire de Meudon, France); Heidmann, J.; Nieto, J. L. Astron. Astrophys.; 41: No. 2, 229-231(Jun 1975).

A set of curves H_0t_0 = constant is given in the observationally relevant region of the (log σ_0,λ_0) plane, where H_0 is the Hubble constant, t_0 the age of the universe, σ_0 the density parameter and λ_0 the reduced cosmological constant. From the analysis of the observational data on H_0, t_0 and σ_0, we provide an upper limit to the cosmological constant. (auth)

1694 CLOSE ASSOCIATIONS OF PAIRS OF OBJECTS AT DIFFERENT DISTANCES. Dolan, J. F. (Case Western Reserve Univ., Cleveland). Astrophys. Lett.; 16: No. 2, 65-66(1975).

The equation of Burbidge et al. (1974) used to calculate chance coincidences between pairs of objects at different distances is observationally investigated and found to be valid. The result supports their inference that the presently known cases of small angular separation can neither prove nor disprove the cosmological distances of QSOs with statistical confidence. (auth)

1695 EARLY STAGES OF THE UNIVERSE. Sciama, D. W. (Oxford Univ.). pp 21-35 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

The possibility of an extrapolation of present conditions and trends into the past is investigated, taking into account a thermalization of the microwave background, the helium problem, and questions concerning the initial singularity. A number of outstanding problems are considered, giving attention to the origin of the black body background, the matter-antimatter universe, dissipative processes in the early universe, and questions concerning the symmetry of the universe. Initial conditions are discussed along with the mix-master universe, the parabolic universe, and the Machian universe. Approaches for eliminating the initial singularity are also explored. (IAA)

1696 ANALYSIS AND DEVELOPMENT OF A VERY SENSITIVE LOW TEMPERATURE GRAVITATIONAL RADIATION DETECTOR. Paik, H. J. Stanford, CA; Stanford Univ. (1975). 333p. University Microfilms Order No. 75-13,573.

Thesis (Ph. D.).

This dissertation consists of two parts: Theory of Gravitational Radiation Detectors (Part I) and Development of a Very Sensitive Cryogenic Detector of Gravitational Radiation (Part II). Part I begins with an analysis of the interaction of gravitational radiation pulses with three-dimensional elastic bodies. This detector theory is then applied to existing Weber-type room temperature detectors with piezoelectric crystal pickup to compare their theoretical sensitivities with actual achieved sensitivities. Part II is essentially the experimental confirmation of the transducer theory developed in Part I. The transducer coupling as a function of persistent current has been verified and possible dissipation mechanisms in the superconducting tunable-diaphragm transducer have been investigated. The preliminary test of the transducer on a prototype gravitational radiation detector of mass 700 kg is discussed in the concluding part of this dissertation. With this prototype detector, it is hoped that the theoretically predicted events in our galaxy will already be detected with a good signal-to-noise ratio. (Diss. Abstr. Int., B)

1697 OBSERVATIONAL VALIDATION OF THE CHRONOMETRIC COSMOLOGY. I. Preliminaries and the Redshift–Magnitude Relation. Segal, I. E. (Massachusetts Inst. of Tech., Cambridge). Proc. Natl. Acad. Sci. U.S.A.; 72: No. 7, 2473-2477 (Jul 1975).

Results of comprehensive observational tests of the cosmological theory proposed by Segal in 1972 are summarized in this and succeeding notes. Within a framework of natural and general causality

and symmetry considerations, the theory is mathematically essentially unique. It implies definite relations between directly observed quantities (redshift, apparent magnitude and diameter, number counts, and the like) which are entirely free of adjustable parameters, such as the q_0 and LAMBDA of general relativistic cosmologies. Rigorous statistical analysis of large (greater than 100) or systematically defined samples of galaxies or quasars accepts these relations at substantial probability levels. Note I establishes uniform statistical procedures and compares the redshift–magnitude relations of major samples with the theoretical relations of the present and expansion theories. (auth)

Planetary Phenomena

Refer also to abstracts 1502, 1538, 1642, 1643, 1759, 1788, and 1839.

1698 (AD/A–003662) ABSOLUTE INFRARED RADIANCE MEASUREMENTS OF VENUS AND JUPITER. Environmental Research Papers. Logan, L. M.; Hunt, G. R.; Long, D. A.; DybWad, J. P. (Air Force Cambridge Research Labs., L.G. Hanscom Field, Mass. (USA)). 15 Nov 1974. 11p. (AFCRL-ERP–494; AFCRL-TR–74-0573). NTIS $3.25.

Balloon-borne measurements of brightness temperatures were made for Venus and Jupiter and are in general agreement with ground-based observations. In all these results, however, there remains a greater variation than can be explained by computed error margins. It is concluded that the absolute brightness temperatures reported here constitute a base from which the constancy of the radiation from Venus and Jupiter can be investigated to determine the usefulness of these planets as infrared calibration sources. (GRA)

1699 (N-75-13770) MAN INVESTIGATES THE PLANETS. Varvarov, N. A. Jun 1974. Translation of Chelovek Issledyuet Planety, Mashinostroyeniye Press, Moscow, 1973. (NASA-TT-F–15313). 179p. NTIS $7.00.

Contemporary scientific concepts about the origin of the earth and the planets of our solar system are discussed along with the satellites of the planets, the minor planets, meteoric objectives, bolides, and meteorites. Why spacecraft are used to study the sun, its accompanying planets, and their satellites is explained. Data about the surface and atmosphere of Mars and Venus and the seasons, days, and climate of these planets are included. Data are given for the contemporary cosmodromes and spacecraft centers, spaceflight devices, and the chemical, nuclear, and electrical rocket motors. Selection of interplanetary trajectories and the peculiarities and conditions for flight to the near and distant celestial objects of our solar system both by automatic unmanned devices and by manned spaceships are discussed. (STAR)

1700 EXTINCT RADIOACTIVITIES: TRAPPED RESIDUALS OF PRESOLAR GRAINS. Clayton, D.D. (Department of Space Physics and Astronomy, Rice University). Astrophys. J. 199: No. 3, 765-769 (1 Aug 1975).

The xenon anomalies trapped in meteorites and the Moon may have first been trapped in circumstellar grains formed in or outside of postexplosive stars. In that case, the initial solar nebula need not have contained most of their radioactive progenitors, and this would necessitate major revision of the history of solar system formation. (auth)

1701 ON THE 23-MICRON FEATURE IN THE SPECTRUM OF JUPITER. Fox, K. (Earth Resources and Astrophysics Laboratory, Department of Physics and Astronomy, University of Tennessee). Astrophys. J. Lett. 199: No. 3, L189-L191 (1 Aug 1975).

The spectroscopic activity of gaseous constituents in the Jovian atmosphere is investigated with a view toward absorption at 23 μ. Various possibilities for the source of this feature are excluded, particularly pressure-induced dipole transitions involving collisions between H_2 and either CH_4 or HD. (auth)

1702 EFFECTS OF TURBULENCE ON RADIO-OCCULTATION SCALE HEIGHTS. Hubbard, W.B.; Jokipii, J.R. (Department of Planetary Sciences, University of Arizona). Astrophys. J. Lett. 199: No. 3, L193-L196 (1 Aug 1975).

We demonstrate that turbulent scattering can produce a spurious value for the radio-occultation—derived scale height of a planetary atmosphere. Application to the Jovian atmosphere shows that recent measurements obtained during the flyby of *Pioneers* 10 and 11 can be substantially affected if suitable large amplitude turbulence is present. Other implications of this possibility are briefly discussed. (auth)

1703 STRUCTURE AND EVOLUTION OF JUPITER: THE FLUID CONTRACTION STAGE. Graboske, H. C. Jr.; Pollack, J. B.; Grossman, A. S.; Olness, R. J. (Univ. of California, Livermore). Astrophys. J.; 199: No. 1, 265-281(1 Jul 1975).

An evolutionary study of a 0.00095 M/solar mass/ star, composed of a convective, adiabatic, homogeneous fluid, has been performed using stellar structure methods. A new numerical technique is used to calculate model atmospheres in the form of time-average vertical temperature structures, including all relevant opacity sources and a solar energy deposition component. Thermodynamic properties for pure hydrogen and a solar mixture (X equals 0.74, Y equals 0.24, Z equals 0.02) are developed for -7 less than or equal to log rho (g cm^{-3}) less than or equal to 1 and 1.78 less than or equal to log T(K) less than or equal to 4.78, utilizing recent high-pressure experimental results and new theoretical methods. The resultant gravitationally contracting evolutionary models exhibit two phases. An early stellar phase, behaving like a typical low-mass pre-main-sequence object, has high luminosities which have left a record in the structure of the Galilean satellites. This phase also has high internal temperatures, (T/sub c/)/sub max/ reaching 51,400, which ensures a long subsequent evolution as a fully mixed, convective structure. The second phase is an approach to a degenerate dwarf cooling curve, which gives excellent agreement with the observed radius and luminosity of Jupiter. A short time scale for the standard adiabatic fluid models (2.6×10^9 years) is extended by combinations of several factors influencing the planetary evolution. An analysis of the sensitivity of evolution to chemical composition, solar energy deposition, equation of state, model atmospheres, and superadiabaticity demonstrates that equation of state and superadiabaticity have the strongest influence over planetary time scales. (auth)

1704 CONSEQUENCES OF THE INCLINATION OF THE ZODIACAL CLOUD ON THE ECLIPTIC. Robley, R. (Observatoire du Pic du Midi, Toulouse). Astron. Astrophys.; 41: No. 3-4, 385-389(Jul 1975). (In French).

Assuming that the decrease in the density of the interplanetary dust follows an exponential distribution both in the transverse and radial direction, we can write $n = n_0 \text{ Exp } (-(h/H) - (r - 1/R))$, where h is the distance from the ecliptic plane and r the heliocentric distance both expressed in astronomical unity (a.u.); then we show that the modulation of the radiance B(90,0) of the zodiacal light observed at the ecliptic pole defines the parameter H as a function of the inclination angle β between the zodiacal cloud and the ecliptic plane; moreover, the experimental value of the ratio (B(90,0))/B(90,90) defines the parameter R. It can be deduced that the flatness of the zodiacal cloud, expressed by R/H, is <5 and that the plane of symmetry of the zodiacal cloud is very close to that of the invariant plane of the solar system ($\beta < 2°$). Assuming that the composition of the interplanetary medium is mainly Fe and SiO_2 grains (not including ice for which the estimated life time is too short), we show that only the dust grains with a size distribution favorising the submicronic grains give a ratio (B(90,0))/B(90,90) close to the observed value. (auth)

1705 VARIATIONS IN GEGENSCHEIN POLARIZATION. Sparrow, J. G.; Weinberg, J. L. (State Univ. of New York, Albany). Astron. Astrophys.; 41: No. 3-4, 475-476(Jul 1975).

The basis for claims of small scale angular structure and day to day variations in the polarized component of the zodiacal light near the antisolar point has been examined and found to be unsubstantiated. (auth)

1706 GROWTH OF THE EARTH–MOON SYSTEM. Whipple, F. L. (Smithsonian Astrophysical Observatory and Harvard College Observatory, Cambridge, MA). pp 469-473 of Highlights of Astronomy. Vol. III. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

It is assumed that the earth and moon became a binary system during their accretional development and that the moon's growth was complete before the dissipation of the solar nebula. Equations for the nebular drag and the tidal drag acting on the proto-moon are equated, yielding an expression for the quasistable-equilibrium distance between the proto-earth and proto-moon in terms of their densities, their radii, the density of the solar nebula, and the tidal lag. Calculated parameters for the proto-earth/proto-moon system are given for various values of the masses and densities of the proto-earth and proto-moon. (IAA)

1707 WAVES AND INSTABILITIES IN THE SOLAR WIND. Hollweg, J. V. (National Center for Atmospheric Research, Boulder, CO). Rev. Geophys. Space Phys.; 13: No. 1, 263-289 (Feb 1975).

We present a review of waves and instabilities in the solar wind, concentrating on those aspects that are likely to play important roles in influencing the dynamic and thermodynamic states of the general solar wind expansion. We consider in particular the roles played by various waves and instabilities in influencing the heating and expansion of the solar wind, the angular momentum of the solar wind, the solar wind thermal anisotropy, the heating and flow of alpha particles in the solar wind, the interstellar neutral particles that become ionized in the solar wind, and the "fluidlike behavior" of the solar wind. We include a brief review of the properties of the hydromagnetic wave modes, concentrating particularly on the

Alfven mode, which has been observed to contribute significantly to the microscale fluctuations of the solar wind. But we also present a summary of observational evidence pertaining to the presence and action in the solar wind of waves and instabilities that are not among the hydromagnetic modes. (auth)

1708 CLASSIFICATION AND PROPERTIES OF IRON METEORITES. Scott, E. R. D.; Wasson, J. T. (Univ. of California, Los Angeles). Rev. Geophys. Space Phys.; 13: No. 4, 527-546 (Aug 1975).

Most (86 percent) iron meteorites can be assigned to one of 12 genetic groups on the basis of systematic variations in their chemical, mineralogical, and structural properties; the remaining 14 percent are termed anomalous. The groups are best resolved on Ga-Ni or Ge-Ni plots, but they may also be defined using other elements, the distribution and morphology of characteristic minerals, and very often kamacite bandwidths. The power of this classification to reveal correlations of numerous and diverse properties within these groups and systematic variations between groups emphasizes its validity. Its use is essential for understanding the formation of iron meteorites. A comparison of the 12 groups suggests that there are two types with very different histories. Each group very probably formed in its own parent body. Groups of the second type seem to have diverse formational histories, but unlike the first type, they were not once part of molten cores. This study is based on results from nearly 500 different iron meteorites, which are listed with their classification together with 70 other paired irons. A comparative study of the properties of the 12 groups is presented without attempting to fit these data to detailed models for their formation. (auth)

1709 THEORETICAL MODELS OF MAGNETIC FIELD LINE MERGING. I. Vasyliunas, V. M. (Massachusetts Inst. of Tech., Cambridge). Rev. Geophys. Space Phys.; 13: No. 1, 303-336(Feb 1975).

Models of magnetic field line merging that consider processes in a limited region around the magnetic X line, within which the external magnetic fields are roughly uniform and antiparallel, are reviewed. Part 1 describes the concept of magnetic merging and then considers the models based on a hydromagnetic approach. The models developed by Sweet and Parker, by Petschek, and by Sonnerup and Yeh and Axford are shown to be fundamentally consistent, representing different aspects of the same problem. The model of Sweet and Parker describes the small region around the neutral line where magnetic field diffusion is the dominant process. The inclusion of inertial as well as finite resistivity effects allows an extension of their model to collisionless plasmas. Petschek's model represents a system with a boundary condition of uniform field at the sides; it has been extended and formulated in a mathematically precise manner. The nonsingular model of Sonnerup and Yeh and Axford has special boundary conditions at the sides producing localized slow mode MHD expansion fans in the external flow; the singular models and the compressible similarity models are physically unrealizable. The maximum merging rate corresponds to flow into the diffusion region at the local Alfven speed, which, however, can be made arbitrarily large by slow mode MHD expansion if suitable boundary conditions are present. (auth)

1710 INFRARED AND RAMAN SPECTROSCOPY OF LUNAR AND TERRESTRIAL MINERALS. Karr, C., Jr. (ed.). New York; Academic Press, Inc. (1975). 387p.

The chapters of this book are arranged according to spectroscopic technique and/or frequency range rather than application, although chapters 4 to 7, dealing largely with remote sensing, are grouped together. There are chapters on visible and near-infrared, followed by those on mid-infrared, far-infrared, and Raman spectroscopy. Applications are roughly divided between lunar and terrestrial, although the broad range of interchangeability of applications is obvious in many instances. (BJG)

1711 POLAR CAP CURRENTS FOR DIFFERENT DIRECTIONS OF THE INTERPLANETARY MAGNETIC FIELD IN THE Y-Z PLANE. Friis-Christensen, E.; Wilhjelm, J. (Danish Meteorological Inst., Copenhagen). J. Geophys. Res.; 80: No. 10, 1248-1260(1 Apr 1975).

During intervals of a steady state condition of the interplanetary magnetic field the geomagnetic variations at the polar cap have been examined as a function of the direction of the interplanetary field in the Y-Z plane of the geocentric solar magnetospheric coordinate system. A prominent feature of the equivalent current patterns during a positive B/sub z/ steady state is the total vanishing of the well-known two-cell current system, which is generally considered to be related to the convection across the polar cap. Another significant effect for a northward interplanetary magnetic field is a poleward shift of the B/sub y/ associated currents at the day side of the polar cap, with no decrease of the current strength. The existence of these currents even during the absence of the two-cell current system indicates that the explanation proposed by Heppner (1972) of the currents' being due to a shift toward the dawn or the dusk of the polar cap convection is not exhaustive. Rather, the magnetic perturbations for a positive B/sub z/ may correspond to merging of the northward interplanetary magnetic field with the open geomagnetic field lines at the poleward boundary of the cusp as suggested by Burch (1973). A pronounced decrease of the B/sub y/ related magnetic perturbations from summer to winter compared to the seasonal variation of the B/sub z/ related disturbances at the polar cap indicates a different origin of the associated currents. (auth)

1712 HELIOGRAPHIC LATITUDE DEPENDENCE OF THE IMF DOMINANT POLARITY IN 1972-1973 USING PIONEER 10 DATA. Rosenberg, R. L. (Univ. of California, Los Angeles). J. Geophys. Res.; 80: No. 10, 1339-1340(1 Apr 1975).

The heliographic latitude dependence of the interplanetary magnetic field (IMF) was studied by using Pioneer 10 data taken from March 1972 through June 1973 over Bartels solar rotation (SR) periods 1896-1913. The daily IMF sector polarities were plotted for each of these SR periods. Then the number of days of positive polarity ("away" directed fields) per SR was plotted versus the average heliographic latitude. The dominant polarity behaved in accordance with the latitude effects found by Rosenberg and Coleman in 1969. The phase of the cycle has reversed from what it was prior to the sunspot maximum in 1968. The polarity is now predominantly positive at northern heliographic latitudes. (auth)

1713 COMMENT ON INTERPLANETARY MAGNETIC SECTOR STRUCTURE, 1926-1971 BY L. SVALGAARD AND CORRESPONDENCE OF SOLAR FIELD SECTOR DIRECTION AND POLAR CAP GEOMAGNETIC FIELD CHANGES FOR 1965 BY W. H. CAMPBELL AND S. MATSUSHITA. Fourger, P. F. (Air Force Cambridge Research Labs., Bedford, MA); Russell, C. T.; Campbell, W. H.; Matsushita, S. J. Geophys. Res.; 80: No. 10, 1376-1378(1 Apr 1975).

A comment and reply is given on Svalgaard's derivation of an index of interplanetary polarity based on the dependence of the diurnal variation of the polar cap geomagnetic field on the solar magnetospheric dawn-dusk component of the interplanetary magnetic field. (BJG)

1714 RADIOGENIC ISOTOPE RESEARCH. Church, S. E. (Univ. of California, Santa Barbara). Rev. Geophys. Space Phys.; 13: No. 3, 98-101(Jul 1975).

The review of the literature presented covers three main areas: geochronology, terrestrial geochronology, and isotopic tracer applications to problems of petrogenesis. Special emphasis is placed on a review of the lunar data. (BJG)

1715 STABLE ISOTOPE GEOCHEMISTRY. Taylor, H. P. Jr. (California Inst. of Tech., Pasadena). Rev. Geophys. Space Phys.; 13: No. 3, 102-107(Jul 1975).

This review is intended principally to be a reasonable comprehensive bibliography. Papers by workers in stable isotope geochemistry in the United States that have been published or presented at national meetings since the last quadrennial report are covered. (auth)

1716 OUTER SOLAR SYSTEM. Owen, T. (State Univ. of New York, Stony Brook). Rev. Geophys. Space Phys.; 13: No. 3, 416-419(Jul 1975).

Several generalizations about the outer solar system are made that give an indication of its special characteristics. A review of current knowledge is presented including discussions on composition, structure, magnetic fields, radiation belts, satellites, and the Rings of Saturn. (BJG)

1717 COSMOGONY OF THE SOLAR SYSTEM. Ward, W. R. (Harvard Coll., Cambridge, MA). Rev. Geophys. Space Phys.; 13: No. 3, 422-424(Jul 1975).

Research on solar system origin over the last four years is covered. Emphasis is placed on the physics of planetary accumulation mechanisms. Pertinent references on the chemistry of mineral condensation and cometary research are included. (BJG)

1718 PLASMA PROCESSES IN THE EXPANSION OF THE SOLAR WIND AND IN THE INTERPLANETARY MEDIUM. Barnes, A. (Ames Research Center, Moffett Field, CA). Rev. Geophys. Space Phys.; 13: No. 3, 1049-1053(Jul 1975).

Research in plasma processes in the expansion of the solar wind and in the interplanetary medium for the period 1971 to 1974 is reviewed. Topics include the radial profile of the interplanetary medium, solar wind theory, hydromagnetic waves, heating and acceleration of the solar wind, electron heat transport, and ion velocity distributions near 1 AU. (BJG)

1719 INTERPLANETARY GAS OF NONSOLAR ORIGIN. Thomas, G. E. (Univ. of California, San Diego, La Jolla). Rev. Geophys. Space Phys.; 13: No. 3, 1063-1065(Jul 1975).

This review covers space observations of the 1216A sky background and the 584A sky background as well as the theory of hydrogen and helium distributions. Prospects of future advances in the study of neutral gas within the solar system are also discussed. (BJG)

1720 GEODYNAMICS PROJECT: INITIAL DEVELOPMENTS IN THE U. S. PROGRAM. Drake, C. L. (Dartmouth Coll., Hanover, NH); Heirtzler, J. R.; Oliver, J. E. Rev. Geophys. Space Phys.; 13: No. 3, 1105-1106(Jul 1975).

The geodynamics project is reviewed. The following topics are covered: fine structure of the crust and upper mantle, mid-Atlantic ridge, drilling for scientific purposes, and plate interiors. (BJG)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstracts 1782–1785, and 1791.

1721 (AD/A–003459) CONTINUOUS-SLOWING-DOWN ELECTRON ENERGY DEPOSITION MODEL. Julienne, P. S. (Naval Research Lab., Washington, D.C. (USA)). Dec 1974. 20p. (NRL-MR–2958). NTIS $3.25.

A simple continuous-slowing-down model of the altitude dependent energy deposition of energetic auroral electrons is described. The computer code uses experimental cross sections in numerical form where they are available, and predicts the volume production rates of the various excitation, ionization, and dissociation processes for the atmospheric species N_2, O_2, and O. Some sample results for the low energy electron flux and for the total energy deposition rate are shown and compared to the predictions of other codes. (GRA)

1722 (AD/A–003461) NUMERICAL STUDIES OF TYPE 2 EQUATORIAL ELECTROJET IRREGULARITY DEVELOPMENT. McDonald, B. E.; Coffey, T. P.; Ossakow, S. L.; Sudan, R. N. (Naval Research Lab., Washington, D.C. (USA)). Dec 1974. 27p. (NRL-MR–2961). NTIS $3.75.

A computer simulation based on fluid equations of motion seems to account for basic observational features of short wavelength type 2 (subsonically propagating) ionization irregularities in the equatorial electrojet. The short wavelengths (less than 28 meters for parameters taken here) are excited only after long wavelengths, horizontally propagating waves grow to an amplitude sufficient to trigger the nonlinear growth of secondary vertically propagating modes. The result is a complicated two dimensional turbulent flow, with convective elements moving with comparable vertical and horizontal velocities. The density fluctuation power spectrum obeys approximately a power law k to the minus 3.5 power. These results agree with theory and observation. (GRA)

1723 (AD/A–003462) IONOSPHERIC CONDUCTANCE FOR SUBAURORAL LATITUDES AT EQUINOX TWILIGHT. Fedder, J. A.; Ossakow, S. L. (Naval Research Lab., Washington, D.C. (USA)). Nov 1974. 16p. (NRL-MR–2933). NTIS $3.25.

In this note, ionospheric conductivities for electric currents perpendicular to the geomagnetic field are presented. The conductivities have been computed for sub-auroral latitudes for spring and autumn twilight conditions to aid in planning and simulation of the Defense Nuclear Agency-sponsored 1975 barium cloud releases in Alaska. (GRA)

1724 (AD/A–003463) PRELIMINARY REPORT ON A PROGRAM TO STUDY PROTON DEPOSITION IN THE ATMOSPHERE. Rogerson, J. E.; Davis, J. (Naval Research Lab., Washington, D.C. (USA)). Dec 1974. 22p. (NRL-MR–2967). NTIS $3.25.

A one-dimensional model based on a continuous slowing down approximation is used to study proton deposition in the atmosphere. The effects of hydrogen atoms created by charge exchange processes with atmospheric gases are included, and secondary electron processes are taken into account. Some preliminary results are presented for several incident-proton energies. (GRA)

1725 (AD/A–003639) AUTOMATIC PROCESSING OF DIGITAL IONOGRAMS. Environmental Research Papers. Cormier, R. J.; Dieter, K. (Air Force Cambridge Research Labs., L.G. Hanscom Field, Mass. (USA)). 7 Oct 1974. 23p. (AFCRL-ERP–489; AFCRL-TR–74-0502). NTIS $3.25.

The automatic processing of ionograms from raw data (as collected by a digital ionospheric sounder) to electron density profiles has been successfully demonstrated using both daytime and nighttime records. The program is not limited to the production of electron density profiles; it is flexible and has the following options: (1) a filtered ionogram output, where the unwanted noise has been eliminated only the wanted signal; (2) A tabulation of ionospheric parameters such as critical frequencies, virtual heights, and the MUF 3000; (3) A tabulation of h'f points for recresting an ionogram; (4) A tabulated output of true height vs electron density. (GRA)

1726 (AD/A–003692) FUNDAMENTAL MECHANISMS IN THE POLAR CAP REGION. Final Report, 2 November 1971-30 June 1974. Green, A. E. S. (Florida Univ., Gainesville (USA). Engineering and Industrial Experiment Station). 21 Oct 1974. Contract F19628-72-C-0122. 119p. NTIS $5.25.

A "detailed atomic cross section" (DACS) approach has been developed and applied to the problem of proton energy deposition in the polar cap atmosphere. Using the systematics of empirical data, expressed by simple analytic forms in conjunction with the Born-Bethe approximation to relate proton and electron impact cross sections at high energies, a set DACS for proton and hydrogen atom impact excitation of N_2, O_2 and O has been assembled. Volume ionization and volume excitation rate profiles necessary for the calculation of spectral emission intensities have been obtained for arbitrary incident proton spectra. Physicochemical processes have been modeled to obtain these contributions to the spectral intensities of low-lying atomic oxygen states. A Monte Carlo method, which allows simulation of the stochastic walk in both energy and position has been developed for application to polar cap processes. (GRA)

1727 (AD/A-003693) ANALYSIS AND PROGRAMMING FOR SCIENTIFIC RESEARCH. Final Report, 1 April 1971–31 August 1974. Bass, J. N.; Bhavnani, K. H.; Hurwitz, M. G.; Lai, S. T.; Stancik, J. L. (Logicon, Inc., Torrance, Calif. (USA)). 30 Sep 1974. Contract F19628-71-C-0154. 146p. NTIS $5.75.

The report describes significant analyses and computer programming problems performed in support of Air Force Cambridge Research Laboratories scientists. Ephemerides systems, orbit determination systems, systems to investigate ionospheric and geomagnetic phenomena, atmospheric density studies, and analyses of satellite wire-boom dynamics have been covered in varying degrees of depth. (GRA)

1728 (AD/A–004602) AURORA: AN NRL AURORAL CHEMISTRY CODE. Hyman, E.; Julienne, P. (Naval Research Lab., Washington, D.C. (USA)). Jan 1975. 34p. (NRL-MR–2965). NTIS $3.75.

A computer code is described which models the chemistry in the atmosphere during and subsequent to the deposition of auroral electrons. In addition to obtaining altitude profiles of 14 atmospheric species as a function of time for any given incident-electron spectrum, the code predicts volume and column emissions of selected UV, visible, and IR spectral lines. Typical results from an ICECAP spectrum are presented. (GRA)

1729 (AD/A–004631) AURORAL BIRKELAND CURRENTS AND ANOMALOUS RESISTANCE. Fedder, J. A.; Orens, J. H. (Naval Research Lab., Washington, D.C. (USA)). Jan 1975. 16p. (NRL-MR–2975). NTIS $3.25.

Presented are results from an auroral arc model which illustrate the physical relationship between the auroral Birkeland currents and an assumed anomalous resistance along the geomagnetic field. It is shown that the distribution of the Birkeland current is very sensitive to the spatial form of the resistance function. It is also observed that for a variety of resistance functions the auroral field distribution remains essentially unchanged. (GRA)

1730 (AD/A–004652) NEUTRAL WINDS AND ELECTRIC FIELDS FROM MODEL STUDIES USING REDUCED IONOGRAMS. Baran, D. E. (Pennsylvania State Univ., University Park (USA). Ionosphere Research Lab.). 10 Oct 1974. Contract N00014-67-A-0385-0017. 145p. (PSU-IRL-SCI–431). NTIS $5.75.

A relationship between the vertical component of the ion velocity and electron density profiles derived from reduced ionograms is developed. Methods for determining the horizontal components of the neutral winds and electric fields by using this relationship and making use of the variations of the inclinations and declinations of the earth's magnetic field are presented. The effects that electric fields have on the neutral wind calculations are estimated to be small but not second order. Seasonal and latitudinal variations of the calculated neutral winds are given and it is shown that these are in general agreement with results from current theoretical models and from measurements. In particular, the midnight reversal of the meridional wind at Arecibo is observed from these calculations. (GRA)

1731 (AD/A-004678) CONTINUATION OF LABORATORY STUDIES OF VLF PROPAGATION EFFECTS IN THE SIMULATED DISTURBED SUB-D REGION. Final Report, 1 May 1968–30 June 1973. Hirsh, M. N.; Eisner, P. N. (Dewey Electronics Corp., Paramus, N. J. (USA)). 25 Nov 1974. Contract DASA01-68-C-0159. 54p. NTIS $3.75.

Ion collision frequencies and ion removal rates due to ion–ion recombination have been deduced from mass spectrometer and conductivity probe measurements in the afterglow of laboratory plasmas produced by high-energy electron bombardment of air-like N2:O2 mixtures at ionospheric pressures. Previous work has shown that the ion species and reaction rates determined from this laboratory plasma are in general agreement with those observed in the ionosphere. The results obtained in this work are relevant

to the calculation of vlf and elf skywave propagation in a disturbed ionosphere. (GRA)

1732 (COM-75-10075) 1964 DIGITAL DATA BASE FOR IONOSPHERIC MODELING. Part A. Bottomside Electron Density Profiles. Goe, G.; Lerfald, G. M.; Jurgens, R. B. (National Oceanic and Atmospheric Administration, Boulder, Colo. (USA). Space Environment Lab.). Oct 1974. 41p. (NOAA-TM-ERL-SEL-35). NTIS $3.75.

Approximately 30,000 film ionograms recorded at ground-based ionospheric sounding stations during 1964 were selected for a pilot study to obtain true height profiles of electron density. A yield of 18,226 interpolated profiles was obtained using a new analysis system developed to automate as far as possible all of the digitizing and data processing steps but to retain the pattern recognition capabilities of a human in scaling the ionograms. The profiles of electron density extend from 90 km up to the height of the peak of the F-layer. One of the features of these profiles is that each is started using the same method. The START subroutine introduces a computed correction for low lying ionization at 90 km. When no E-layer data can be scaled from the ionogram, a subroutine (ELAYER) computes model data to represent the height and curvature of the layer. Digitized comments recorded for each profile include information about the extent of spread F, the height of multiple echoes, and other intermittent ionospheric features such as traveling disturbances. (GRA)

1733 (COM-75-50058) ENERGETIC PROTONS IN THE keV ENERGY RANGE AND ASSOCIATED keV ELECTRONS OBSERVED AT VARIOUS LOCAL TIMES AND DISTURBANCE LEVELS IN THE UPPER IONOSPHERE. Hultqvist, B.; Borg, H.; Christophersen, P.; Riedler, W.; Bernstein, W. (National Oceanic and Atmospheric Administration, Boulder, Colo. (USA). Space Environment Lab.). Jan 1974. 158p. (NOAA-TR-ERL-305; SEL-29). GPO.

keV proton measurements on board the near-earth polar-orbiting satellites ESRO IA and IB are analyzed and discussed, in particular in relation to simultaneously obtained keV electron data. Data are presented for all local times and for low, medium, and high K^p values. Some of the conclusions about the physical processes affecting the deV auroral particles that can be drawn on the basis of the observational results are given. (GRA)

1734 (COM-75-50059) GLOBAL SCINTILLATION MODEL. Pope, J. H. (National Oceanic and Atmospheric Administration, Boulder, Colo. (USA). Space Environment Lab.). Aug 1974. 37p. (NOAA-TR-ERL-308; SEL-30). GPO.

This report describes a recently developed global scintillation model and its use for estimating scintillation effects under various operational conditions. This model includes frequency, solar cycle activity, seasonal effects, diurnal effects, and variations with global location. Certain geometrical effects are also considered. (GRA)

1735 ROCKET-BORNE PARTICLE, FIELD, AND PLASMA OBSERVATIONS IN THE CLEFT REGION. Ungstrup, E.; Bahnsen, A. (Danish Space Research Institute, Lyngby, Denmark); Olesen, J.K.; Primdahl, F.; Spangslev, F.; Heikkila, W.J.; Klumpar, D.M.; Winningham, J.D.; Fahleson, U.; Falthammar, C.; Pedersen, A. Geophys. Res. Lett. 2: No. 8, 345-348 (Aug 1975).

First results of comprehensive observations of magnetic and electric fields, and ambient and suprathermal plasmas above the dayside auroral oval with rocket-borne instrumentation which penetrated the cleft region are reported. Measurements were also obtained equatorward and poleward of the cleft. Convection velocities as inferred from electric field measurements were generally toward noon equatorward of the cleft and were antisunward over the polar cap. Our observations of electron temperatures, electric fields and low-frequency electrostatic noise provide strong evidence of a plasma instability (Farley-Buneman) in the E-layer, which is associated with the appearance of the 'slant E condition' identified in ground-acquired ionograms. The positions of these measurements relative to that of the cleft were firmly established via the determination of the plasma environment with an electrostatic analyzer. (auth)

1736 SOLAR CYCLE DEPENDENCE OF DRIFT ANISOTROPY OF E- AND F-REGION IRREGULARITIES AT WALTAIR. Hanumath Sastri, J.; Ramachandra Rao, B. (Andhra Univ., Waltair, India). Indian J. Radio Space Phys.; 2: No. 2, 95-97(Jun 1973).

Horizontal drift data covering a period of half-a-solar cycle including both IGY and IQSY are treated by the correlation function method with a view to inferring solar cycle dependence, if any, of drift and anisotropy of irregularities in E- and F-regions. It is found that there is no significant change in the statistical features of true drift speed, random velocity and axial ratio with the phase of the solar cycle for both E- and F-regions. A comparison of the salient features of the present study for the local summer with those of an earlier investigation for local winter reveals a seasonal dependence of the effect of solar activity on drift and anisotropy of E- and F-region irregularities. (auth)

1737 SHORT-PERIOD VARIATIONS IN THE DRIFT AND ANISOTROPY PARAMETERS OF THE SMALL SCALE IRREGULARITIES. Murthy, B. S. N.; Ramachandra Rao, B. (Andhra Univ., Waltair, India). Indian J. Radio Space Phys.; 2: No. 2, 143-147(Jun 1973).

Variations in the drift and anisotropy parameters of the small scale irregularities are observed in the successive samples, each of 1-min duration, of the fading records of E and F regions of the ionosphere. A parameter "Σ" is defined as the sum of the percentage changes in V_a, V, V_c, r and a plus the total angular changes in ϕ_a, ϕ and ψ, and when Σ is plotted against the time interval between the records, an irregular variation is noticed from the plot. Various possible causes for the variations observed are discussed. (auth)

1738 NIGHT-TIME HIGH MULTIPLE REFLECTIONS FROM THE F LAYER AND IONOSPHERIC ABSORPTION. Saha, A. K. (National Physical Lab., New Delhi, India). Indian J. Radio Space Phys.; 2: No. 2, 139-142(Jun 1973).

High-multiple reflections are believed to be caused by focusing effects through wavelike disturbances in the reflecting layer. The frequency of occurrence of these echoes, however, shows seasonal and solar cycle variations. It is suggested that such variations are due to changes in the shape of the F-layer and consequent changes in deviative absorption in the rays reflected from the varying gradients of electron density. (auth)

1739 LATITUDINAL DISTRIBUTION OF ELECTRON CONCENTRATION FROM THE ALOUETTE-II TOPSIDE SOUNDER. Pandey, V. K.; Mahajan, K. K. (National Physical Lab., New Delhi, India). Indian J. Radio Space Phys.; 2: No. 2, 134-138 (Jun 1973).

Electron density profiles from the Alouette-II satellite are used to study the latitudinal distribution of electrons to heights up to 3000 km in the topside ionosphere. The electron density in the topside decreases as one goes away from the equator, resulting in a trough at mid to high latitudes for both day and night conditions in the winter hemisphere and only for night conditions in other seasons. This trough, however, is not always seen at the F2 peak. On the dayside, while the trough is not observed for altitudes up to 1000 km, the higher altitudes indicate a tendency towards the formation of the trough. The plasma scale heights, obtained from the electron density profiles, show a sharp decrease at and above the trough latitudes, indicating the dominance of atomic oxygen ions and the depletion of lighter ions at these latitudes. These results are in agreement with the ion composition measurements on various satellites and the polar wind theory which predicts an upward plasma flow at the high latitudes. (auth)

1740 VELOCITY OF ATMOSPHERIC GRAVITY WAVES IN THE F2 REGION OF THE IONOSPHERE OVER DELHI. Gupta, A. B.; Nagpal, O. P.; Setty, C. S. G. K. (Univ. of Delhi). Indian J. Radio Space Phys.; 2: No. 2, 123-130(Jun 1973).

Extensive measurements of the small scale fluctuations in the F2-region critical frequency made at Delhi (dip = 42.4°) reveal the presence of atmospheric gravity waves. Vertical speeds of these waves have been determined from the cross-correlation of radio signals obtained from various points aligned vertically in the ionosphere. A component of the wave velocity in the magnetic meridian plane has also been obtained. These speeds lie within the permissible range of internal gravity wave speeds. Estimates of the vertical wave lengths have also been made using the observed dominant periods of these waves and the vertical speed. The observed vertical wavelengths are mostly in the range 50-500 km. These estimates provide an opportunity to evaluate the total wavelength and the trace velocity of the waves assuming the validity of the simplified theory. (auth)

1741 VARIATION OF D REGION ABSORPTION AT DELHI. Seera, G. S.; Dubey, R. C.; Setty, C. S. G. K. (Univ. of Delhi). Indian J. Radio Space Phys.; 2: No. 2, 119-122(Jun 1973).

Absorption measurements have been made at Delhi during midday using the A1 technique for the period October 1969 to December 1970. The radio frequency used was 5.7 MHz. Ionograms taken during this period have been analyzed for true heights. The absorption suffered by the radio wave up to the height of reflection has been calculated using the experimental N(h) profile and an assumed model of electron collision frequency. This calculated absorption has been divided into two parts: (a) absorption suffered in the E-layer L(E) (in the height range 95-160 km) and (b) absorption in the F-layer L (F) (from 160 km to the height of reflection). It is found that the total calculated absorption L(E) + L(F) is always less than the experimental value. This is attributed to the absorption in the D-region (below 95 km), denoted by L(D). It is found that L(D) is maximum in equinoxes with low values in summer and winter. (auth)

1742 EXTENSION OF THE TWO-COLOR METHOD TO EVALUATE THE BAND INTENSITIES IN THE NIGHT AIRGLOW.

Kulkarni, P. V.; Ramachandra Rao, V. (Physical Research Lab., Ahmedabad, India). Indian J. Radio Space Phys.; 2: No. 2, 114-118(Jun 1973).

In the filter photometry of the night airglow two filters are used, one centred on an "emission line" and the other excluding the line, estimating the "background". The extension of this "two color method" for reduction of OH molecular band intensities is described. The errors involved due to the approximations are discussed. It is pointed out that one of the most important but uncertain factors in evaluating absolute intensities is the estimation of the ratio of the background intensities in the two wavelength regions transmitted by "emission" and "background" filters. (auth)

1743 REGULARITIES IN THE BEHAVIOR OF SOME ANOMALIES IN F2 REGION. Chaudhary, C. P. (Bengal Engineering Coll., Howrah, India). Indian J. Radio Space Phys.; 2: No. 2, 110-113(Jun 1973).

The ratio of the electron density existing at any time to the calculated electron density at the level of maximum electron production for solar zenith distance $\chi = 0$ has been computed for F_2-layer heights from observed data at Thumba and Ahmedabad. The residue obtained after subtracting the theoretical Chapman value from the actual value, when subjected to harmonic analysis yields prominent periodicities. Seasonal effect in the periodicities is found to depend on latitude and is simpler near the equator than at higher latitudes. (auth)

1744 HEIGHT OF MAXIMUM EMISSION OF 6300 Å NIGHT AIRGLOW AND ELECTRON CONTENT IN THE F REGION AT LOW LATITUDES. Ramachandra Rao, V. (Physical Research Lab., Ahmedabad, India). Indian J. Radio Space Phys.; 2: No. 2, 107-109(Jun 1973).

From the electron density profiles of Ahmedabad and the airglow observations made at Mt. Abu, India, a determination of height of maximum intensity is made for the 6300 Å night airglow emission. It is concluded that the maximum intensity of emission (i) is in the height region 300-400 km, and (ii) is not critically dependent on the height of the maximum electron density. (auth)

1745 DETERMINATION OF HEIGHT OF Es PATCHES FROM REGULAR SATELLITE SCINTILLATION PATTERNS. Dutta, H. N.; Manchanda, T. C.; Lal, J. B. (Kurukshetra Univ., India). Indian J. Radio Space Phys.; 2: No. 2, 98-100(Jun 1973).

The occurrence of the regular satellite scintillation and the height of the corresponding Es patches have been studied. Most of the diffraction patterns are seen to occur during day-time. It has been shown that height as determined from the regular diffraction patterns for Es patches situated at small zenith angles may be more in error than that for large zenith angles. (auth)

1746 HISTORICAL DEVELOPMENT OF FORECASTING METHODS FOR IONOSPHERIC PROPAGATION OF hf WAVES. Rawer, K. (Institut fuer Physikalische Weltraumforschung, Freiburg, i.B.). Radio Sci.; 10: No. 7, 669-679 (Jul 1975).

Short wave forecasting began in the late 1930s with rather crude, more global methods. The main steps of the development until the middle of the 1950s are described. Analytical methods have now replaced the original ones. (auth)

1747 GEOPHYSICAL INVESTIGATIONS BY SCATTERED RADIO WAVES. Dieminger, W. (Max-Planck-Institut fuer Aeronomie, Lindau, Ger.). Radio Sci.; 10: No. 7, 681-691 (Jul 1975).

The application of scattered radio waves to geophysical investigations is reviewed. The occurrence of ground scatter depends on the smoothness of the reflecting layer and limits for the inhomogeneity may be given. Direct backscatter occurs from field-aligned irregularities in the auroral belt and movements may be derived from Doppler shift. The location and temporal movement of the two predominant precipitation belts are observed. Meteor scatter is strongly aspect sensitive and is used for deriving physical properties of the meteorites. The analysis of scattering in transequatorial short wave propagation points to a gravity wave induced system of eastward travelling field-aligned inhomogeneities. Incoherent scatter has proved a successful tool for investigating many important parameters of the ionosphere. Satellite scintillations are helpful in mapping the irregularities of the electron content. They may be used for determining the height of the irregularities by radio wave holography. Scattering of microwaves on the ground is becoming a useful tool for geoexploration. (auth)

1748 CURRENT AND FUTURE TRENDS IN IONOSPHERIC RESEARCH. Bowhill, S. A. (Univ. of Illinois, Urbana). Radio Sci.; 10: No. 7, 693-697 (Jul 1975).

In the early days of upper atmosphere research, radio signals were the most useful diagnostic for studying ionospheric processes. During the space era, it has become possible to measure directly solar radiations that are screened from reaching the surface of the Earth, to measure the structure and composition of the upper atmosphere directly with in situ sensors, to conduct plasma experiments in space, to carry out remote sensing of the atmosphere from space, and to measure directly transionospheric radio propagation properties of the ionosphere. This recent dominance of space research methods in ionospheric research is becoming less marked as satellite opportunities diminish and greater emphasis is placed on studies of the ionosphere using new types of ground-based instrumentation. Looking to the 1980s, the principal space flight opportunities will be associated with Spacelab, and new initiatives in ionospheric research will depend on a combined approach using all available methods for studying the dynamics and structure of the ionosphere. Future possibilities are outlined, with particular reference to new radio experiments on the ionosphere. (auth)

1749 MAGNETIC STORMS AND IONOSPHERIC FORECASTING OVER ITALY. Dominici, P. (Istituto Nazionale di Geofisica, Rome). Radio Sci.; 10: No. 7, 699-703 (Jul 1975).

A statistical analysis of 90 selected ionospheric storms has been carried out from MUF(ZERO)F_2 and MUF(3000)F_2 measured in Italy from 1958 to 1972. Typical behavior with regard to season, storm intensity, and statistical dispersion is shown for forecasting purposes. (auth)

1750 AROUND-THE-WORLD PROPAGATION. Rumi, G. C. (Istituto Elettrotecnico Nazionale Galileo Farraris, Turin). Radio Sci.; 10: No. 7, 711-718 (Jul 1975).

Data on around-the-world (RTW) propagation obtained at Ithaca, N. Y., between the years 1965 and 1968 are described and discussed using a ray optics approach. The role of the oblique ionospheric shells that are known to exist near the 75° dip of the northern geomagnetic field in producing RTW echoes is emphasized. The possibility of utilizing RTW waves for ionospheric sounding is pointed out. (auth)

1751 EFFECTS OF THE TROPOSPHERE ON THE PROPAGATION TIME OF MICROWAVE SIGNALS. Thompson, M. C. (Institute for Telecommunication Sciences, Boulder, CO). Radio Sci.; 10: No. 7, 727-733 (Jul 1975).

Technological developments in the microwave spectrum have made possible highly accurate radio systems for position determination. Most of these systems depend upon measurements of the signal transit time or of the differential transit time for different portions of the received wavefront. In practice, the performance of such systems when operating in the Earth's atmosphere is usually limited by the random signal velocity. This effect is a consequence of the variable density and water vapor distribution throughout the normal troposphere. Theoretical and experimental work has provided a useful degree of understanding of these tropospheric effects and some progress has been made in reducing them in certain applications. (auth)

1752 RADIO PROBING OF THE TROPOSPHERE. Little, C. G. (National Oceanic and Atmospheric Administration, Boulder, CO). Radio Sci.; 10: No. 7, 735-742 (Jul 1975).

Radio wave interactions with the atmosphere and its constituents have been used to derive information on many aspects of the troposphere. Passively (i.e., in the radiometric mode), they have been used to measure temperature profiles and the water vapor and liquid water contents of the atmosphere, and to identify tornadic storms. In the active mode, three-dimensional fields of precipitation and velocity have been measured. These have permitted studies of horizontal and vertical velocities, vorticity, convergence, turbulence spectra, turbulent kinetic energy dissipation rates, and fluxes of momentum and kinetic energy, as well as studies of such atmospheric phenomena as thermal plumes, convective cells, internal gravity waves, breaking waves, and convective and orographic storms. (auth)

1753 RESEARCH ON STATISTICAL ASPECTS OF TROPOSPHERIC PROPAGATION. Barzilai, G. (Univ. of Rome). Radio Sci.; 10: No. 7, 745-752 (Jul 1975).

In microwave links, atmospheric inhomogeneities and terrain irregularities produce random fluctuations of the electromagnetic field whose comprehensive description requires a statistical approach. To this purpose several functions can be defined and measured. Among them, the normalized mutual coherence function, or complex degree of coherence, has proved to be the most convenient both for direct applications and for simple measuring procedure. The Istituto di Elettronica of the University of Rome is carrying on measurements of the degree of coherence of microwave fields. It has been measured for different paths at 9.4 GHz by using waveguide interferometric systems of various configurations which have been applied to the determination of the coherence function for several distances in the horizontal plane, and to the evaluation

of its anisotropy in a plane transverse to the direction of propagation for different meteorological conditions. (auth)

1754 NONLINEAR SATURATION AND ANGULAR ROTATION OF INSTABILITIES IN THE E LAYER. Weinstock, J.; Rognlien, T. D. (National Oceanic and Atmospheric Administration, Boulder, CO). Radio Sci.; 10: No. 3, 231-237(Mar 1975).

Two plasma instabilities have been identified as causing small-scale irregularities in the equatorial E layer. These instabilities are referred to as the two-stream and gradient drift instabilities. Here a unified calculation is made of the saturated density amplitudes of these instabilities. The present nonlinear saturation mechanism is referred to as perturbed orbits or diffusing orbits. The density fluctuations required for this saturation are roughly 10 percent for the gradient drift instability and 1 percent for the two-stream instability. This agrees with rocket measurements over India. In addition, a calculation is made of the frequency shift of two-stream waves. This shift is a nonlinear effect due to the slowing down of electrons by the unstable waves, and could be viewed as an enhanced friction. It is shown that this frequency shift will cause the angular spectrum of the two-stream waves to be rotated upwards or downwards, depending on the direction of the electrojet. Such rotations have been observed by radar. (auth)

1755 ELECTRON DENSITY PROFILES FROM IONOGRAMS: UNDERLYING IONIZATION CORRECTIONS AND THEIR COMPARISON WITH ROCKET RESULTS. Wright, J. W. (National Oceanic and Atmospheric Administration, Boulder, CO); Paul, A. K.; Mechtly, E. A. Radio Sci.; 10: No. 3, 255-270(Mar 1975).

Electron density profiles from nine daytime rocket flights at Wallops Island, Va., conducted by the University of Illinois at high and low levels of solar activity, are compared with profiles calculated by inversion of ionograms obtained at the same times and location. Sources of error and uncertainty in the ionogram inversion are discussed, as are means for their amelioration. In most cases, agreement between the two kinds of measurement within a few percent in electron density and within a few percent of a scale height can be achieved. (auth)

1756 HORIZONTAL STRUCTURE OF MIDLATITUDE SPORADIC-E LAYERS OBSERVED BY INCOHERENT SCATTER RADAR. Miller, K. L.; Smith, L. G. (Univ. of Illinois, Urbana). Radio Sci.; 10: No. 3, 271-276(Mar 1975).

An investigation of the horizontal structure of sporadic-E layers has been made using the incoherent scatter radar at the Arecibo Observatory. Data are presented for two observations, one with the radar beam held in a vertical position, and another with the beam scanning in azimuth across the sporadic-E layer. The first observation was made at sunset and shows the passage of a large region of ionization, about 150 km in extent, having little small-scale horizontal structure. The second, at midday, shows considerable variation in the value of the maximum electron density in the vertical cross section of an intense sporadic-E layer. The horizontal dimensions of the features range in size down to the resolution of the radar (300 m). By considering the data statistically it is shown that small patches, 300 m or less in horizontal extent, exist in the sporadic-E layer with densities great enough to account for the maximum frequency of the echo recorded on the ionosonde located at the observatory. (auth)

1757 CHATANIKA RADAR INVESTIGATION OF HIGH LATITUDE E-REGION IONIZATION STRUCTURE AND DYNAMICS. Hunsucker, R. D. (Univ. of Alaska, Fairbanks). Radio Sci.; 10: No. 3, 277-288(Mar 1975).

Simultaneous Chatanika incoherent scatter radar, auroral all-sky camera, and photometric data are utilized to delineate the structure and dynamics of the auroral E layer for various types of disturbances. The vertical distribution of ionization (N/sub e/(h) profiles) is presented and discussed for various disturbance phenomena, such as the great geomagnetic storm of August 2-9, 1972, intense auroral particle precipitation events (March 16, 1972, March 2, 1973), and auroral infrasonic wave disturbances, April 2, 1973. N/sub e/(h) profiles for quiet conditions and for a slowly varying disturbance (the July 10, 1972, solar eclipse) are shown for comparison purposes. (auth)

1758 ELECTRON HEATING RATES IN THE E AND LOWER F REGIONS. Schutz, S. R.; Smith, L. G.; Voss, H. D. (Univ. of Illinois, Urbana). Radio Sci.; 10: No. 3, 289-295(Mar 1975).

Electron temperatures and electron densities measured on four rocket flights have been used to deduce electron heating rates in the E and lower F regions. Above 150 km heating rates at midday are found to be in good agreement with calculated values. Anomalies are found in the heating rates at sunrise which are attributed to a source, such as joule heating, which does not produce ionization. (auth)

1759 IONIZING NIGHTGLOW: SOURCES, INTENSITY, AND SPATIAL DISTRIBUTION. Young, J. M.; Troy, B. E. Jr.; Johnson, C. Y.; Holmes, J. C. (Naval Research Lab., Washington, DC). Radio Sci.; 10: No. 3, 297-304(Mar 1975).

Photometers carried aboard an Aerobee rocket mapped the ultraviolet night sky at White Sands, New Mexico. Maps for five 300 A passbands in the wavelength range 170 to 1400 A reveal spatial radiation patterns unique to each spectral subregion. The major ultraviolet features seen in these maps are ascribed to a variety of sources: 1) solar Lyman alpha (1216 A) and Lyman beta (1026 A), resonantly scattered by geocoronal hydrogen; 2) solar HeII (304 A) resonantly scattered by ionized helium in the Earth's plasmasphere; 3) solar HeI (584 A) resonantly scattered by neutral helium in the interstellar wind and Doppler shifted so that it penetrates the Earth's helium blanket; and 4) starlight in the 912 to 1400 A band, primarily from early-type stars in the Orion region. Not explained are the presence of small, but measurable, albedo signals observed near the peak of flight. Intensities vary from several kilorayleighs for Lyman alpha to a few rayleighs for HeII. (auth)

1760 SEASONAL AND SOLAR CYCLE VARIATION OF E-REGION NITRIC OXIDE. Golshan, N.; Sechrist, C. F. Jr. (Univ. of Illinois, Urbana). Radio Sci.; 10: No. 3, 305-315(Mar 1975).

Measured electron density and $[NO^+]/[O_2^+]$ data are used to deduce the seasonal and solar activity variation of E-region nitric oxide concentration. The results imply a strong dependence of [NO] on soft X rays leading to the possibility that dissociation of N_2 by energetic photoelectrons is a major source of $N(^2D)$. Seasonal variations of the thermosphere apparently cause enhanced [NO] in summer in agreement with the summer enhancement of experimental $[NO^+]/[O_2^+]$. (auth)

1761 DETERMINATION OF NITRIC OXIDE CONCENTRATIONS FROM SUNRISE E-REGION ELECTRON DENSITY MEASUREMENTS. Monro, P. E.; Smith, L. G. (Univ. of Illinois, Urbana). Radio Sci.; 10: No. 3, 317-323(Mar 1975).

Midlatitude sunrise electron density profiles have been analyzed in order to determine nitric oxide concentrations in the range 100-160 km. In general, the determinations are restricted to heights for which the ionization of nitric oxide by direct solar Lyman-alpha radiation is the main contribution to the growth of the E region. The concentrations obtained are larger, by factors of approximately 3 to 4, than those obtained from the midlatitude airglow measurements of other workers. Concentrations have been obtained from one sunset measurement and these are significantly lower than the sunrise values. The results also give a clear indication of increasing nitric oxide concentrations above 120 km with increasing solar activity. (auth)

1762 RADAR EVIDENCE FOR Fe^+ IN A SPORADIC-E LAYER. Behnke, R. A. (Arecibo Observatory, Puerto Rico); Vickrey, J. F. Radio Sci.; 10: No. 3, 325-327(Mar 1975).

Incoherent scatter results are presented using compressed-pulse techniques to study a sporadic-E layer at Arecibo. Multiple Barker-coded pulses were used to obtain the autocorrelation function of the E/sub s/ layer. A 13-bit code with a baud length of 4 mu sec was employed, resulting in 600-m height resolution. The observations are examined for the presence of Fe^+ by least-square fitting the measured autocorrelation functions to a library of theoretical ones. The analysis indicates that Fe^+ dominates in the E/sub s/ layer, usually providing about 70 percent of the ionization. (auth)

1763 ANALYSIS OF NIGHTTIME E-REGION WINDS AND IONIZATION PRODUCTION. Geller, M. A. (Univ. of Illinois, Urbana); Smith, L. G.; Voss, H. D. Radio Sci.; 10: No. 3, 335-345(Mar 1975).

Two sets of rocket measurements of nighttime E-region electron densities at Wallops Island are analyzed. One is a series of five electron density profiles that were taken during the night of February 22, 1968, and the other is a collection of electron density profiles that were taken near midnight under varying conditions of geomagnetic activity. The method of analysis uses the steady-state continuity equation for electrons and gives information on the height-averaged ionization production rate and the vertical profile of the ion drift. Conclusions drawn from this analysis include the following: The more marked intermediate layer observed under geomagnetically quiet conditions is most likely a straightforward consequence of lesser ionization rates. Small values of vertical ion drift (about 10 m sec^{-1}) are sufficient to give rise to a marked intermediate layer. Electron production in the E region is minimum near midnight. The production rate below 130 km (probably HI L beta) increases sharply between 0130 and 0300 EST whereas the production rate in the region above remains relatively constant. The ionization

rate in the nighttime E region varies strongly with Kp. The intermediate layer may be a result of electron redistribution by the tidal winds of the (2,4) mode of the solar semidiurnal tide. (auth)

1764 TIDAL EFFECTS IN THE E REGION FROM INCOHERENT SCATTER RADAR OBSERVATIONS. Salah, J. E.; Wand, R. H.; Evans, J. V. (Massachusetts Inst. of Tech., Lexington). Radio Sci.; 10: No. 3, 347-355(Mar 1975).

Measurements of the neutral temperature in the altitude region 100 to 130 km during the past several years at Millstone Hill (42°N) and St. Santin (45°N) have revealed that, on the average, there exist strong semidiurnal tidal effects which can be identified with the (2,4) tidal mode propagating from the stratomesosphere. The average amplitude of the temperature oscillation reaches a maximum of about 35 K at 116 km with maxima at 0630 and 1830 hr LT. At each station, large variability is found in amplitude and phase from one observing period to another, particularly during winter. The average temperature behavior implies a semidiurnal zonal wind oscillation with an amplitude of about 45 m sec^{-1} at 110 km having eastward maxima at about 0500 and 1700 hr LT, and a meridional component with similar amplitude having southward maxima at 0800 and 2000 hr LT. The downward phase velocity is about 4 km hr^{-1}. These results are in good agreement with direct wind measurements at St. Santin, and with some recently reported characteristics of the height variations of sporadic-E at midlatitudes. At Arecibo (18°N), semidiurnal oscillations have also been found to dominate the E-region temperature and wind structure with similar amplitude and phase velocities as above; however, the observed phase behavior is more variable than at midlatitudes and the average results do not allow reliable mode identification. Some results of recent simultaneous observations at low and midlatitudes are presented which imply that during any particular observing period, the E-region structure must be controlled by local effects. (auth)

1765 COMPARISON OF ARECIBO E-REGION DATA AND SPORADIC-E THEORY: A MEASUREMENT OF THE DIFFUSION COEFFICIENT. Harper, R. M. (National Astronomy and Ionosphere Center, Arecibo, Puerto Rico); Wand, R. H.; Whitehead, J. D. Radio Sci.; 10: No. 3, 357-361(Mar 1975).

Incoherent scatter measurements using multiple-pulse techniques were performed at Arecibo to study the E region with a height resolution of 2.4 km. These simultaneous measurements of ion temperature, ion-neutral collision frequency, and electron density, as well as horizontal and vertical components of ion drift velocity, have allowed comparison between theories of sporadic-E and experiment. Sporadic-E layers were consistently observed to descend along the curve where the vertical ion drift velocity (V/sub z) was zero and its gradient delta V/sub z//delta Z was negative, as predicted by redistribution theory. Assuming no diffusion, the calculated effective recombination coefficient at the layer peak is more than an order of magnitude too small for NO^+ or O_2^+, and varies with height in a manner which is unacceptable for a recombination coefficient. This indicates that the layer is composed of long-lived ions (probably metallic), and that the peak layer density is controlled by diffusion rather than recombination. By ignoring recombination, the diffusion coefficient was estimated from the layer thickness and the vertical gradient in the vertical ion velocity. The results were compared with independent values calculated from the measurements of ion temperature and ion-neutral collision frequency. The two estimates were in good agreement over the range 110 to 120 km, showing that electron densities in sporadic-E layers are primarily determined by molecular diffusion. (auth)

1766 NUMERICAL MODELLING OF A METALLIC ION SPORADIC-E LAYER. MacLeod, M. A.; Keneshea, T. J.; Narcisi, R. S. (Air Force Cambridge Research Labs., Bedford, MA). Radio Sci.; 10: No. 3, 371-388(Mar 1975).

A one-dimensional time-dependent model of the ionosphere has been developed and applied to the study of a metallic ion sporadic-E layer observed in the Aladdin 1 experiment carried out at Eglin AFB, Florida, 20 November 1970. The model develops the molecular ion background ionosphere using a dynamic photochemical calculation from noon to a time near model sunset. A representative metallic ion altitude profile is then introduced, the divergence terms included in the continuity equations, and the integration carried forward. Introducing an ad hoc constant electric field of 2 mv m^{-1} directed to the south, the model metallic ion sporadic-E layer forms at the proper altitude and reaches the measured peak density in about a half hour. Changing the initial metallic ion profile changes the time to reach peak density and the degree of asymmetry of the layer, but the layer altitude is determined asymptotically by the location of the convergent node of the vertical ion velocity profile. The background ionospheric density calculated with the model agrees within experimental error with the experimental profile. The calculations support the hypothesis that midlatitude sporadic-E layers are caused by neutral-wind-induced compression of metallic ions resulting from meteoric ablation in the lower E region. (auth)

1767 ESTIMATE OF THE GLOBAL-SCALE JOULE HEATING RATES IN THE THERMOSPHERE DUE TO TIME MEAN CURRENTS. Roble, R. G.; Matsushita, S. (National Center for Atmospheric Research, Boulder, CO). Radio Sci.; 10: No. 3, 389-399(Mar 1975).

An estimate of the global-scale joule heating rates in the thermosphere is made based on derived global equivalent overhead electric current systems in the dynamo region during geomagnetically quiet and disturbed periods. The equivalent total electric field distribution is calculated from Ohm's law. The global-scale joule heating rates are calculated for various monthly average periods in 1965. The calculated joule heating rates maximize at high latitudes in the early evening and postmidnight sectors. During geomagnetically quiet times the daytime joule heating rates are considerably lower than heating by solar EUV radiation. However, during geomagnetically disturbed periods the estimated joule heating rates increase by an order of magnitude and can locally exceed the solar EUV heating rates. The results show that joule heating is an important and at times the dominant energy source at high latitudes. However, the global mean joule heating rates calculated near solar minimum are generally small compared to the global mean solar EUV heating rates. (auth)

1768 ELECTRIC FIELD MEASUREMENTS IN THE AURORAL E REGION. Mahon, H. P. (Univ. of Massachusetts, Boston); Smiddy, M.; Sagalyn, R. C. Radio Sci.; 10: No. 3, 401-407(Mar 1975).

Dipole electric field, positive ion and electron densities and temperatures, vehicle potential, and plasma sheath measurements have been made in the auroral E region by means of rockets flown from Fort Churchill, Canada. These results are described and compared over the altitude region 100 to 165 km. On a rocket flight launched on 10 December 1969 during very quiet conditions, adjacent to a stable, low intensity auroral arc, the plasma density and temperatures are found to be high and the electric fields large and steady. Electric field components of the order of -17 mv m^{-1} to +6 mv m^{-1} were measured along the Earth's magnetic field. The plasma results indicate that these fields may be contributing to enhanced electron temperatures. On a flight of 9 March 1970 during a large magnetic storm with widespread auroral activity, lower plasma densities and temperatures and much smaller and more erratic electric fields were observed with no significant component parallel to the magnetic field. (auth)

1769 IONOSPHERE-MAGNETOSPHERE COUPLING. I. Thermal Plasma. Chappell, C. R. (Marshall Space Flight Center, Huntsville, AL). Rev. Geophys. Space Phys.; 13: No. 3, 872-873(Jul 1975).

The basic processes which connect the thermal plasma population of the ionosphere with that of the outer magnetosphere are discussed. Improved measurement techniques enable observations of the dynamics of the ionization in these regions as well as their detailed morphology. (BJG)

1770 IONOSPHERE-MAGNETOSPHERE COUPLING. II. Electric Fields. Banks, P. M. (Univ. of California, San Diego, La Jolla). Rev. Geophys. Space Phys.; 13: No. 3, 874-878(Jul 1975).

Individual observations and theories are fitted into the broader framework of magnetosphere-ionosphere-atmosphere couplings as they impact upon the general behavior of quasi-static electric fields within the magnetosphere and ionosphere. Magnetospheric substorms are viewed as departures from the usual pattern of behavior. Electric fields in the vicinity of auroral arcs are regarded as special processes. (BJG)

1771 IONOSPHERE-MAGNETOSPHERE COUPLING. III. A Review of the Role of Wave-Particle Interactions. Thorne, R. M. (Univ. of California, Los Angeles). Rev. Geophys. Space Phys.; 13: No. 3, 878-881(Jul 1975).

Resonant interactions between waves and particles in the magnetosphere can cause a violation of the three adiabatic invariants. Third-invariant violation by fluctuating long-period electric and magnetic fields acts as a major source for the inner radiation zone. Precipitation into the atmosphere induced by pitch angle diffusion associated with a violation of either of the first two invariants provides a major loss mechanism for geomagnetically trapped particles. Detailed models have been proposed to describe the nonadiabatic transfer of particles and energy from the magnetosphere and their effect on the upper atmosphere. A discussion of recent advances in our understanding of four areas is presented: auroral zone precipitation, relativistic electron precipitation

events, the proton ring current and stable auroral red arcs, and middle-latitude electron precipitation. (auth)

1772 THERMAL STRUCTURE OF THE IONOSPHERE. Brace, L. H. (Goddard Space Flight Center, Greenbelt, MD). Rev. Geophys. Space Phys.; 13: No. 3, 882-883 (Jul 1975).

A brief review of the progress that has been made in the last four years toward obtaining a more complete understanding of the thermal structure of the ionosphere is presented. (auth)

1773 IONOSPHERIC IRREGULARITIES. Perkins, F. W. (Princeton Univ., NJ). Rev. Geophys. Space Phys.; 13: No. 3, 884 (Jul 1975).

The nature of ionospheric irregularities is discussed and the current work being done in this area is presented. (BJG)

1774 THERMOSPHERIC COMPOSITION. Carignan, G. R. (Univ. of Michigan, Ann Arbor). Rev. Geophys. Space Phys.; 13: No. 3, 885-887 (Jul 1975).

The global view of the atmosphere that has been provided by satellite observations in concert with radar backscatter measurements has shown a pattern of composition variability that theorists have been able to explain in large part as resulting from dynamic processes. Important progress has been made in defining composition variability at 120 km, which has greatly improved models which previously had fixed boundary conditions at that altitude. The discovery of the early morning maximum in helium abundance and the better definition of diurnal variation in relative composition have provided a basis for more sophisticated dynamical models. Similarly, models of meridional wind systems have been developed which can account for the better-defined winter enhancement in helium and atomic oxygen. Finally, composition variability has indicated the presence of a high-latitude heat source which during periods of magnetic activity profoundly modifies the state of the atmosphere. Some important contributions to our improved understanding of thermospheric composition are reviewed in this paper. (auth)

1775 REVIEW OF F REGION DYNAMICS. Evans, J. V. Massachusetts Inst. of Tech., Lexington). Rev. Geophys. Space Phys.; 13: No. 3, 887-894 (Jul 1975).

The major developments in the dynamics of the F region brought about by neutral winds, electric fields, vertical diffusion, and waves are outlined. (BJG)

1776 IONOSPHERIC D AND E REGIONS. Sechrist, C. F. Jr. (Univ. of Illinois, Urbana). Rev. Geophys. Space Phys.; 13: No. 3, 894-900 (Jul 1975).

In a review of ionospheric D and E regions, the following topics are covered: minor neutral species, ionization sources, ion composition and chemistry, electron density profiles, effective electron loss coefficients, laboratory measurements, model studies, and Sporadic E. Some areas for future study are mentioned. (BJG)

1777 MINOR CONSTITUENTS IN THE STRATOSPHERE AND MESOSPHERE. Cicerone, R. J. (Univ. of Michigan, Ann Arbor). Rev. Geophys. Space Phys.; 13: No. 3, 900-903 (Jul 1975).

This paper is a brief survey of a portion of the research on trace constituents in the stratosphere and mesosphere between 1971 and 1974. A great deal of progress has been reported in understanding both the present background stratosphere and the responses to be expected from additions of nitrogen oxides, water, and chlorine oxides, especially with respect to ozone. Trace constituents in the mesosphere have been modeled and measured to increase our understanding of the physics and chemistry of the mesosphere but also to relate mesospheric composition and transport to ionospheric processes at higher altitudes, to D region ion chemistry, and to upper stratospheric composition. (auth)

Magnetospheric Phenomena

Refer also to abstracts 1623, 1727, and 1769–1771.

1778 (AD/A-003751) GEOMAGNETICALLY TRAPPED RADIATION. Schulz, M. (Aerospace Corp., El Segundo, Calif. (USA). Space Physics Lab.). 17 Dec 1974. Contract F04701-74-C-0075. 116p. NTIS $5.25.

Contents: Adiabatic drift shells; Parasitic pitch-angle diffusion; Formation of inner electron belt; Artificial radiation belts; Empirical studies of particle diffusion; Inner-zone protons; Alpha-proton ratio; Cold-plasma injection. (GRA)

1779 COMPOSITION AND ENERGY SPECTRA OF HEAVY NUCLEI OF UNKNOWN ORIGIN DETECTED ON SKYLAB. Chan, J.H.; Price, P.B. (Department of Physics, University of California, Berkeley, California 94720). Phys. Rev. Lett. 35: No. 8, 539-542 (25 Aug 1975).

At the orbit of Skylab we observed steeply falling energy spectra of nuclei with $Z \geq 8$ and $10 \lesssim E \lesssim 40$ MeV/amu at intensities much higher than seen outside the magnetosphere. The composition is O:Ne:[Na-Si]:Fe = 100:33:13:(~2), consistent with that of the solar corona. We suggest that heavy solar-wind ions enter the magnetosphere, are accelerated, and populate the inner radiation belt. (auth)

1780 TOPOLOGY OF THE GEOMAGNETIC FIELD. Bochnicek, J. (CSAV, Prague). Cesk. Cas. Fys.; 25: No. 4, 365-375 (1975). (In Czech).

Various models of the magnetosphere are discussed in the paper. These models have been divided into closed and open ones. It is shown that neither by means of closed models nor by open ones it is possible to explain all phenomena which are observed in the magnetosphere. In the conclusion the problems on which the future magnetospheric research should concentrate are outlined. (auth)

1781 SPATIAL AND TEMPORAL VARIATIONS OF ULF DISTURBANCES NEAR L = 4 DURING A MAGNETIC STORM. Maclennan, C. G.; Lanzerotti, L. J.; Fukunishi, H. (Bell Telephone Labs., Inc., Murray Hill, NJ). pp 377-383 of Magnetospheric Physics. Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From Conference on magnetospheric physics; Sheffield, Eng. (13 Aug 1973).

Latitudinal and conjugate observations of ULF variations near L equals 4 during the December 17, 1971, magnetic storm are discussed. The temporal variations in the latitude of the peak power in the 10 to 15 mHz band may be indicative of plasma density gradients in the magnetosphere. Diurnal variations are observed in the signal coherences between the observations at the several stations. (IAA)

1782 OBSERVATIONS OF BIRKELAND CURRENTS AT AURORAL LATITUDES. Anderson, H. R.; Vondrak, R. R. (Rice Univ., Houston, TX). Rev. Geophys. Space Phys.; 13: No. 1, 243-262 (Feb 1975).

After many years of languishing interest, field-aligned currents (Birkeland currents) are now regarded as an important link between the magnetosphere and the ionosphere. We describe techniques that are used to measure them and then discuss in some detail measurements that have been interpreted as indicating the presence of Birkeland currents. We conclude that measurements substantiate the theory of large-scale flow from the magnetosphere to the polar caps in a dawn-dusk direction with opposite flow equatorward of the auroral zone connecting to the Alfven layer. Sheet current flow in premidnight discrete aurora seems experimentally established also, but its connection with auroral acceleration and with the larger-scale flow is not yet understood. The currents flowing during a substorm are not yet fully defined either. (auth)

1783 WAVE–PARTICLE INTERACTIONS IN THE MAGNETOSPHERE AND IONOSPHERE. Thorne, R. M. (Univ. of California, Los Angeles). Rev. Geophys. Space Phys.; 13: No. 1, 291-302 (Feb 1975).

Two distinct aspects of the interaction between waves and particles in the earth's magnetosphere and ionosphere were discussed at the Yosemite Conference on Magnetosphere-Ionosphere Coupling; these will be briefly reviewed. Intense field-aligned currents flow between the ionosphere and magnetosphere at auroral latitudes. Under certain conditions these currents can become unstable, permitting potential drops to be established along the field lines. The present status of experimental evidence favoring such parallel electric fields is somewhat controversial. Theoretical models for their origin invoke regions of anomalous resistivity or electrostatic double layers. To date it is impossible to distinguish between these alternatives on the basis of experimental data. The nonadiabatic behavior of magnetospheric ring current particles during geomagnetic storms is largely controlled by wave-particle processes. During the storm main phase, intense fluctuating convection electric fields are responsible for injecting trapped particles into the outer radiation zone. The outer radiation zone also moves in closer to the earth following the storm time compression of the plasmapause. Simultaneous pitch angle scattering by higher-frequency plasma turbulence causes precipitation loss near the strong diffusion limit throughout the outer magnetosphere. During the storm recovery phase the plasmapause slowly moves out toward its prestorm location; energetic particle loss at such times appears to be dominated by cyclotron resonant scattering from electromagnetic turbulence. (auth)

1784 OBSERVATIONS AND THEORY OF THE FORMATION OF STABLE AURORAL RED ARCS. Rees, M. H. (Univ. of Colorado, Boulder); Roble, R. G. Rev. Geophys. Space Phys.; 13: No. 1, 201-242 (Feb 1975).

A population of protons with energy of some tens of keV, called the ring current, is found near the equatorial region of the mag-

netosphere at several earth radii. During the main phase of geomagnetic storms the ring current shifts toward lower L values into the region of the plasmapause, which is characterized by steep gradients in the plasma density. This interaction together with an anisotropic pitch angle distribution leads to ring current instability and the growth of ion cyclotron wave turbulence. As wave energy is dissipated in the ambient electron gas by Landau damping, the plasmapause electron temperature is raised to a few electron volts, and a substantial temperature gradient is created with respect to the ionosphere. The energy transferred to the ionosphere by pitch angle scattering in the low collision frequency region and by heat conduction in the collision-dominated regime raises the ionospheric electron temperature to several thousand degrees. Therefore an appreciable number of electrons in the high-energy tail of the Maxwellian distribution, i.e., electrons with energy greater than 2 eV, exist in the F region of the ionosphere at about 400 km, where atomic oxygen is the dominant neutral gas constituent. Two eV is the threshold for excitation of oxygen atoms to the metastable ^1D level, and these $O(^1D)$ atoms emit 6300-A radiation, the signature of stable auroral red (SAR) arcs. An SAR arc is an optical manifestation of a slow release of energy from the magnetosphere during a geomagnetic storm. Energetically it is small in comparison with high-latitude auroral processes. (auth)

1785 DEVELOPMENTS IN THE THEORY OF RADIO PROPAGATION, 1900–1950. Booker, H. (Univ. of California, San Diego). Radio Sci.; 10: No. 7, 665-668 (Jul 1975).

Developments in the theory of radio propagation in the first half of the twentieth century are briefly traced from early work on diffraction around the curved surface of the Earth to the discovery of the magnetosphere with the aid of whistlers. Attention is drawn to the possibility that Marconi may have been initially inspired by the concept of the Atlantic Ocean as a giant cost-free telephone wire linking the European and American continents. (auth)

1786 THEORETICAL PROPERTIES OF TWO-DIMENSIONAL ELECTROJET TURBULENCE. Rogniien, T. D.; Weinstock, J. (National Oceanic and Atmospheric Administration, Boulder, CO). Radio Sci.; 10: No. 3, 239-246(Mar 1975).

Turbulence in the equatorial electrojet is attributed to the nonlinear evolution of the gradient drift instability. Solutions are given for a set of nonlinear coupled differential equations for the amplitudes of a two-dimensional Fourier series representing the density fluctuations. The differential equations are derived from the electrons by retaining the divergence of electron flux as the only nonlinearity. The results pertain to daytime conditions when dissociative recombination is the dominant linear wave damping mechanism. The irregularities reach amplitudes of approximately 10 percent and are found to break up into smaller dominant scale sizes in the horizontal westward direction than in the vertical direction. A steepening of the density waveform appears in the vertical direction. Perturbed electron velocities form vortex patterns and reach magnitudes comparable to the mean electrojet drift speed. (auth)

1787 NUMERICAL STUDIES OF TYPE 2 EQUATORIAL ELECTROJET IRREGULARITY DEVELOPMENT. McDonald, B. E.; Coffey, T. P.; Ossakow, S. L.; Sudan, R. N. (Naval Research Lab., Washington, DC). Radio Sci.; 10: No. 3, 247-254 (Mar 1975).

A computer simulation based on fluid equations of motion seems to account for basic observational features of short wavelength type 2 (subsonically propagating) ionization irregularities in the equatorial electrojet. The short wavelengths (less than 28 m for parameters taken here) are excited only after long wavelength, horizontally propagating waves grow to an amplitude sufficient to trigger the nonlinear growth of secondary vertically propagating modes. The result is a complicated two-dimensional turbulent flow, with convective elements moving with comparable vertical and horizontal velocities. The density fluctuation power spectrum obeys approximately a power law $k^{-3.5}$. These results agree with theory and observation. (auth)

1788 RELATION OF VARIATIONS IN TOTAL MAGNETIC FIELD AT HIGH LATITUDE WITH THE PARAMETERS OF THE INTERPLANETARY MAGNETIC FIELD AND WITH DP 2 FLUCTUATIONS. Langel, R. A. (Goddard Space Flight Center, Greenbelt, MD). J. Geophys. Res.; 80: No. 10, 1261-1270(1 Apr 1975).

Disturbances in total magnetic field magnitude DELTA B are generally positive from 2200 to 1000 MLT and negative from 1000 to 2200 MLT. The maximum disturbances from the positive and negative regions of DELTA B (B/sub p/ and B/sub n/, respectively) are investigated with respect to their correlation with the average north-south component B/sub z/, the average angle theta with respect to the solar magnetospheric equatorial plane, the variance sigma/sub i/, and the magnitude B/sub i/ of the interplanetary magnetic field. These quantities were averaged over a period T ranging from 20 min to 8 hours prior to the measurement of B/sub p/ or B/sub n/. In the correlation with B/sub z/ two methods were used: direct correlation with B/sub z/ and correlation with the sum B/sub SIGMA/ equals SIGMA B/sub z//T, where B/sub z/ less than 0. For B/sub n/ versus B/sub SIGMA/, data were divided into an equinoctial period and a winter period. Maximum correlations of 0.63 at T equals 200 min and 0.70 at T equals 60 min were obtained for equinox and winter, respectively. In all cases the peak in the correlation coefficient, when it was plotted against T, was very broad. Correlations with all other parameters were smaller than the correlation for B/sub SIGMA/. Examination of B/sub p/ as a function of average B/sub z/ shows that an approximately linear relation holds for B/sub z/ less than 0 and that for B/sub z/ greater than 0, B/sub p/ is relatively constant. Significant magnitudes of DELTA B are found to occur in both the positive and negative regions even when the interplanetary field has been northward for over an hour. Comparison of the occurrence of disturbance in DELTA B with the occurrence of DP 2 fluctuations indicates no correlation between the two phenomena. (auth)

1789 SOME PROPERTIES OF THE SVALGAARD A/C INDEX. Russell, C. T.; Burton, R. K.; McPherron, R. L. (Univ. of California, Los Angeles). J. Geophys. Res.; 80: No. 10, 1349-1351(1 Apr 1975).

Several properties of the A/C index of polar cap variations introduced by L. Svalgaard in 1972 have been found to vary with time. In the presatellite era, C days, as measured by the Ap index, are almost twice as geomagnetically active as A days, while in the modern epoch they have essentially identical activity. Prior to 1962 there were over 40 percent more A days than C days per year, while during the modern epoch there are essentially equal numbers of A days and C days. In view of this strong bias to assigning a "toward" classification on geomagnetically active days we recommend against using the Svalgaard A/C classification in studies of geomagnetic activity. We further recommend that a full and thorough documentation of the index be prepared and/or that others undertake to compile such a classification separately. (auth)

1790 TEMPERATURE EFFECTS ON WHISTLER MODES NEAR GYRORESONANCE. Willis, J. W. (Naval Research Lab., Washington, DC). J. Geophys. Res.; 80: No. 10, 1354-1356(1 Apr 1975).

The dispersion relation for the electron cyclotron mode propagating parallel to the magnetic field is calculated for a Maxwellian plasma by using various densities and temperatures appropriate to the magnetosphere. In addition to the phenomenon of cyclotron damping it is noted that the inclusion of temperature effects markedly changes the wavelength for frequencies above 0.9 omega /sub ce/. A similar result is obtained in the case of the ion cyclotron mode. The altered omega-k diagrams have significant impact on proposed three-wave interaction mechanisms. (auth)

1791 OBSERVATIONS OF EQUATORIAL EUV BANDS: EVIDENCE FOR LOW-ALTITUDE PRECIPITATION OF RING CURRENT HELIUM. Meier, R. R.; Weller, C. S. (Naval Research Lab., Washington, DC). J. Geophys. Res.; 80: No. 19, 2813-2818(1 Jul 1975).

A new extreme ultraviolet (EUV) emission in the 170- to 400-A spectral range has been regularly observed at night when looking down over the magnetic dip equator from an earth orbiting satellite at 750-km altitude. The radiation is believed to be lambda less than or equal to 304 A recombination emission from energetic helium ions and appears as a single arc, quite distinct in spatial form from the oxygen emission arcs. The magnitude of the EUV emission correlates with indices of geomagnetic activity, indicating that precipitating particles are the energy source. A mechanism is proposed in which alpha particles scatter downward from the ring current repeatedly recombine and strip as they enter the atmosphere and lose energy. As a result, numerous excited atomic states are created, and EUV emissions is produced. A computer-coded model of this process using Monte Carlo techniques has been developed. Comparison of the observations with models has yielded information on the altitude and scale height of the emitting region. (auth)

1792 ADVANCES IN MAGNETOSPHERIC PHYSICS: AURORA. Eather, R. H. (Boston Coll., Chestnut Hill, MA). Rev. Geophys. Space Phys.; 13: No. 3, 925-943(Jul 1975).

A review of progress in auroral physics is presented including topics on the following: atomic and molecular processes, morphology and models, photometry, imaging, particle precipitation, electric fields and currents, the ionosphere, artificial aurora, red arcs, auroral audibility, and areas for future research. (BJG)

1793 ADVANCES IN MAGNETOSPHERIC PHYSICS: ENERGETIC PARTICLES. West, H. I. Jr. (Univ. of California, Liver-

more). Rev. Geophys. Space Phys.; 13: No. 3, 943-951(Jul 1975).

An account is given of energetic particle research in magnetospheric physics for the time period 1971-1974. Emphasis is on relating the various aspects of energetic particles to magnetospheric processes. (auth)

1794 MAGNETOSPHERIC PHYSICS: MAGNETIC FIELDS. Russell, C. T. (Univ. of California, Los Angeles). Rev. Geophys. Space Phys.; 13: No. 3, 952-955(Jul 1975).

This progress report on magnetospheric magnetic fields covers the calendar years 1971 to 1974 inclusive. The following topics are discussed: topology of the magnetosphere, bow shock, upstream phenomena, magnetosheath and magnetopause, polar cusp, the tail and plasma sheet, outer magnetosphere and magnetic field models, various magnetospheric processes, magnetospheric dynamics, and auroral phenomena. (BJG)

1795 SOLAR WIND: MAGNETOSPHERE COUPLING. Crooker, N. U. (Massachusetts Inst. of Tech., Cambridge). Rev. Geophys. Space Phys.; 13: No. 3, 955-958(Jul 1975).

The interplanetary magnetic field has been firmly established as a major influence in interactions between the solar wind and the magnetosphere. Evidence of its control over magnetospheric processes provides the thread of continuity in the following sections of this report: merging, polar cap disturbances and sector polarity, geomagnetic activity and solar wind structure, periodicities in geomagnetic activity, access of solar wind particles to the magnetosphere, the magnetospause, and the bow shock. (auth)

1796 RESEARCH IN MAGNETOSPHERIC WAVE PHENOMENA. Barfield, J. N. (National Oceanic and Atmospheric Administration, Boulder, CO). Rev. Geophys. Space Phys.; 13: No. 3, 959-967(Jul 1975).

During the last 4 years a number of developments have occurred which have led to an increased understanding of the role of wave phenomena in the physical processes of the magnetosphere. While the studies span the frequency regime from millihertz to the electron gyrofrequency, the developments to be discussed in this paper have in common that they have added substantially to the understanding of the controlling processes, regions, and boundaries in the magnetosphere. The topics discussed are the increased awareness and documentation of the role of the plasmapause in micropulsation generation and propagation; the establishment of the role of ion cyclotron waves in the wave-particle interactions at the plasmapause; the discovery of magnetospheric electrostatic waves with omega equals (3/2)OMEGA/sub -/; the discovery and preliminary identification of the source of plasmaspheric hiss; and the analysis of storm time Pc 5 waves as observed on the satellites ATS 1 and Explorer 45. (auth)

1797 PLANETARY MAGNETOSPHERES. Hill, T. W.; Michel, F. C. (Rice Univ., Houston, TX). Rev. Geophys. Space Phys.; 13: No. 3, 967-974(Jul 1975).

Recent planetary probes have resulted in the realization of the generality of magnetospheric interactions between the solar wind and the planets. The three categories of planetary magnetospheres are discussed: intrinsic slowly rotating magnetospheres, intrinsic rapidly rotating magnetospheres, and induced magnetospheres. (BJG)

1798 MAGNETOSPHERIC AND AURORAL PLASMAS: A SHORT SURVEY OF PROGRESS. Frank, L. A. (Univ. of Iowa, Iowa City). Rev. Geophys. Space Phys.; 13: No. 3, 974-989(Jul 1975).

Important milestones in our researches of auroral and magnetospheric plasmas for the past quadrennium 1971-1975 are reviewed. Many exciting findings, including those of the polar cusp, the polar wind, the explosive disruptions of the magnetotail, the interactions of hot plasmas with the plasmapause, the auroral field-aligned currents, and the striking inverted V electron precipitation events, were reported during this period. Solutions to major questions concerning the origins and acceleration of these plasmas appear possible in the near future. A comprehensive bibliography of current research is appended to this brief survey of auroral and magnetospheric plasmas. (auth)

1799 GEOMAGNETIC STORMS AND SUBSTORMS. Siscoe, G. L. (Massachusetts Inst. of Tech., Cambridge). Rev. Geophys. Space Phys.; 13: No. 3, 990-993(July 1975).

This report is divided into two main parts corresponding roughly to observations and interpretations. The observation section is subdivided into papers concerned with the solar wind, geomagnetic tail, the magnetosphere, and the ionosphere and atmosphere. These regions are of course interdependent, and the boundaries between them are not sharp. However, most papers are clearly assignable to one of the three groups. The few that are not are assigned to the most appropriate one or are multiply referenced. Papers on subjects included in other reports in this series are mentioned here if they bear directly on storms and substorms. Papers on the ionospheric storms and the storm response of the neutral atmosphere are included in the references. (auth)

PHYSICS (ATOMIC AND MOLECULAR)

Beams and Their Reactions

Refer also to abstracts 1840 and 2215.

1800 (AD/A-003756) SPECTRAL CHARACTERIZATION OF PULSED ELECTRON BEAMS WITH ENERGIES BELOW 60 keV BY CALORIMETRIC TRANSMISSION MEASUREMENTS THROUGH THIN ALUMINUM FOILS. Graven, W. M. (Aerospace Corp., El Segundo, Calif. (USA)). 11 Dec 1974. Contract F04701-74-C-0075. 37p. NTIS $3.75.

Energy spectra have been determined for a pulsed source of electrons with energies below 60 keV. Measurements of fluence transmission through 0.75-micrometer thick aluminum foils were made with a 12-element calorimeter. Each element was covered with a different number of foils to obtain a complete transmission profile from a single pulse. Spectra unfolded from the transmission profiles were compared with those obtained from diode voltage and current data recorded during the pulse. Agreement of the spectra determined by these two independent methods substantiates the diagnostic methods currently used for low-energy pulsed electron beams. (GRA)

1801 (AD/A-004829) SCATTERING OF MOLECULAR HYDROGEN AND ITS ISOTOPES FROM CRYSTAL SURFACES. Rowe, R. G. (Illinois Univ., Urbana (USA). Coordinated Science Lab.). Jan 1975. Contract DAAB07-72-C-0259. 235p. (R-669; UILU-ENG-75-2201). NTIS $7.50.

Molecular beam scattering of a thermal beam of H_2 from vacuum cleaved (001) surfaces of MgO and LiF, and (111) surfaces of CaF_2 and BaF_2 has been examined. The scattering of He, D_2 and HD from MgO (001) has also been investigated. The angular distribution of scattered flux indicates strong molecular diffraction from these surfaces. These results indicate that the surface structures of the crystals agree with those of the corresponding bulk planes. In addition to elastic diffraction maxima, strong extra peaks have been observed for hydrogen and its isotopes. (GRA)

1802 (CONF-750839-1) BACKSCATTERING OF LIGHT IONS FROM METAL SURFACES. Verbeek, H. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. 31p. Dep. NTIS $4.75.

From symposium on radiation effects on solid surfaces; Chicago, Illinois, USA (25 Aug 1975).

When a metal target is bombarded with light ions some are implanted and some are reflected from the surface or backscattered from deeper layers. This results in an energy distribution of the backscattered particles which reaches from zero to almost the primary energy. The number of the backscattered particles and their energy, angular, and charge distributions depends largely on the energy and the ion target combination. For high energies (i.e., greater than 50 keV for protons) particles are backscattered in a single collision governed by the Rutherford cross section. Protons and He-ions with energies of 100 keV to several MeV are widely used for thin film analysis. For lower energies multiple collisions and the screening of the Coulomb potential have to be taken into account, which makes the theoretical treatment more difficult. This energy region is, however, of special interest in the field of nuclear fusion research. Some recent results for energies below 20 keV are discussed in some detail. (auth)

1803 (SAND-75-5526) REPLACEMENT COLLISION PROBABILITIES FOR ENERGETIC INCIDENT IONS. Brice, D. K. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 22p. (CONF-750926-1). Dep. NTIS $4.25.

From international conference on applications of ion beams to materials; Warwick, UK (9 Sep 1975).

Calculations are presented of P(E), the exact integral equation which governs the replacement probability as a function of incident ion energy in an elastic interaction with a target atom. The calculations are numerical solutions as a function of ion energy and mass, and are obtained using the Thomas-Fermi elastic scattering cross section. (GHT)

1804 UNSTABLE FLOW OF A MAGNETICALLY FOCUSED UNNEUTRALIZED RELATIVISTIC ELECTRON BEAM. Friedman, M. (Naval Research Laboratory, Washington, D.C. 20375). Phys. Rev. Lett. 35: No. 9, 572-574 (1 Sept 1975).

High-amplitude electron waves with relativistic group velocities were induced on a magnetically focused unneutralized relativistic electron beam. These waves were moving antiparallel to the beam direction and were found to modify drastically the macroscopic beam parameters. The group velocity of these waves depends on the axial magnetic field intensity and on the wave frequency. The importance of this effect to certain applications for relativistic electron beams is discussed. (auth)

1805 REDEPOSITION OF SPUTTERED SPECIES DURING ION ETCHING OF Cu, Ag, AND Au. Miller, A.C.; Czanderna, A.W. (Department of Physics and Institute of Colloid and Surface Science, Clarkson College of Technology, Potsdam, New York 13676). J. Vac. Sci. Technol. 12: No. 5, 1086-1087 (Sept 1975).

The redeposition of sputtered Au, Ag, and Cu onto glass surfaces, which are in the same plane as bombarded metal foils, has been established by ion scattering spectrometry. Sites near the sputtering center were analyzed with sensitivities of 0.0008–0.001 monolayers after neon bombardmant of the foils for up to two hours. From the data, the redeposition coverage is estimated to be from 0.009_4 to 0.04_2 monolayers after two hours of Ne bombardment at 1500 eV. The electric field of the incident ion beam, acting on low-energy sputtered ions, is a likely cause of the redeposited material. (auth)

1806 SURFACE EFFECTS ON THE ANGULAR DISTRIBUTIONS OF SAMARIUM VAPOR EFFUSING FROM CYLINDRICAL ORIFICES. Grimley, R.T.; Wagner, L.C.; Castle, P.M. (Department of Chemistry, Purdue University, West Lafayette, Indiana 47907). J. Appl. Phys. 46: No. 9, 4090-4092 (Sept 1975).

A mass-spectrometric investigation has been made of the angular distributions of atomic samarium vapor effusing from cylindrical orifices of varying geometries and materials. Neither the theoretical angular distribution curves obtained from the Clausing theory nor any of the existing modifications of this theory coincided with the experimental distributions. The substantial effect of orifice material on the angular distribution curves suggests the possibility of bulk diffusion in the orifice walls as a contributory factor. (auth)

1807 DEFLECTION OF CsF MOLECULES BY RESONANT INHOMOGENEOUS ELECTRIC FIELDS. Hill, R.M.; Gallagher, T.F. (Molecular Physics Center, Stanford Research Institute, Menlo Park, California 94025). Phys. Rev. A 12: No. 2, 451-459 (Aug 1975).

An experiment that tests a novel method for deflecting molecular beams using inhomogeneous resonance fields is described. The idea is easily understood in classical terms. Imagine that the rotating electric dipole moment of a polar diatomic molecule is placed in an electric field. In a static field the $\vec{\mu} \cdot \vec{E}$ interaction averages to zero due to the rotation of the molecule. If, however, the field rotates at the same frequency as the molecule, the field and molecule remain aligned and the $\vec{\mu} \cdot \vec{E}$ interaction does not average to zero. If the field is spatially inhomogeneous, then there is a net force $-\nabla (\vec{\mu} \cdot \vec{E})$ on the molecule. This force can be used in making a molecular beam deflector. Resonance deflection of molecules in the $J = 0$ and 1 rotational states of a molecular beam of CsF has been observed. The deflection is produced by passing a collimated molecular beam of CsF through the center of a TE_{111} microwave cavity which is oscillating at the $J = 0 \rightarrow 1$ transition frequency, 11.019 GHz. The deflection of the $J = 0$ and 1 molecules can be detected as a decrease in the undeflected on-axis beam or as an increase in the off-axis beam. The theory of the effect as well as potential applications are also discussed. (auth)

1808 EXTRACTION OF THE SPEED DISTRIBUTION FUNCTION FROM A TIME-OF-FLIGHT SIGNAL. Young, W.S. (Energy and Kinetics Department, School of Engineering and Applied Science, University of California, Los Angeles, California 90024). J. Appl. Phys. 46: No. 9, 3888-3893 (Sept 1975).

The molecular-beam speed distribution functions obtained in free-jet expansions using existing time-of-flight (TOF) techniques are subject to distortions caused by the gate function of the beam chopper, $A(t)$, and the dynamic function of the detector and its electronics, $g_d(t)$. Mathematically, the TOF signal is represented by a doubly convoluted Volterra integral equation involving the three functions cited above. In this paper, the Volterra integral equation is inverted twice, using the Laplace-transform method, for known functions of $g_d(t)$ and $A(t)$. The time-domain distribution function $F(t)$ is decoupled from the functions $g_d(t)$ and $A(t)$. Hence, the distortion-corrected speed distribution function is obtained. An example using the CO_2 TOF signal demonstrates the numerical inverting technique. (auth)

1809 PLASMA-SURFACE SOURCE OF NEGATIVE IONS. Bel'chenko, Yu.I.; Dimov, G.I.; Dudnikov, V.G. (Institute of Nuclear Physics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk). Sov. Phys.-Tech. Phys. 20: No. 1, 40-43 (July 1975).

A high-power pulsed source of negative ions that uses a planotron discharge is described. A H^- beam with a current density up to 3.7 A/cm^2 in the emission slit has been obtained from the discharge chamber as a result of the intense emission of negative ions from the cathode surface, which is bombarded by fast particles from the discharge. The intensity of the extracted ion beam is roughly proportional to the area of the emission slit. A negative-ion beam with a current of 0.88 A has been obtained from a source with an emission slit 0.9×30 mm in size; the electron current is less than 1.7 A. (auth)

1810 MEASUREMENT OF THE INTENSITY AND DENSITY OF A MOLECULAR BEAM. Vostrikov, A. A.; Kusner, Yu. S.; Rebrov, A. K.; Semyachkin, B. E. (Inst. of Heat Physics, Novosibirsk, USSR). Instrum. Exp. Tech.; 18: No. 1, 205-207(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 177-179(1975).

An analysis is given of the process of measurement of the intensity on modulation of the molecular beam. The conditions of measurement of the beam intensity with maximum sensitivity are formulated and the measuring system with a LM-2 pressure transducer is described. The beam density is measured with a MKh-7301 mass spectrometer and its conversion to a wider range of masses is described. The results of the measurements of the intensity and density of a gasdynamic beam are given. (auth)

1811 APPARATUS FOR COATING SUBSTRATES BY CATHODE SPUTTERING AND FOR CLEANING BY ION BOMBARDMENT IN THE SAME VACUUM VESSEL. Fiedler, O.; Horhold, R. (to VEB Elektromat). British Patent 1,391,842/B/. 23 Apr 1975. Filed date 7 Apr 1972. 8p.

An apparatus is described for coating substrates by cathode sputtering and for cleaning the surfaces of the substrates by ion bombardment in the same vacuum vessel. The arrangement of the electrodes is described. (UK)

1812 SPUTTERING OF Fe(III) CRYSTAL UNDER Ar^+ AND Kr^+ ION BOMBARDMENT. Bhattacharya, R. S.; Basu, D.; Karmohapatro, S. B. (Saha Inst. of Nuclear Physics, Calcutta). Indian J. Phys.; 48: No. 10, 941-943(Oct 1974).

Sputtering yields of Fe(111) monocrystal under the bombardment of normally incident Ar^+ and Kr^+ ions from an electromagnetic isotope separator are reported for the energy range 15 to 35 keV. There was no significant change in sputtering ratio with ion energy in this energy range. It was found that the focusing collision chain length plays a significant role in sputtering. (1 figure) (RWR)

1813 EXPERIMENTAL STUDY OF A LAMBSHIFT SOURCE FOR THE PRODUCTION OF POLARIZED DEUTERIUM IONS WITH POSITIVE CHARGE WITH THE HELP OF CHARGE EXCHANGE REACTIONS. Finken, D. Karlsruhe, Ger.; Karlsruhe, Univ. (1972). 41p. (In German). INIS.

Thesis.

This study is concerned with investigations of the basic physics of charge exchange reactions for the generation of positively charged dueterium ions by means of a Lamb shift source. In a magnetic field of approximately 600 Oe and an electric field of 10 V/cm the lifetimes of the hyperfine structure component of the hydrogen atom in the first excited metastable state ($2S^1/_2$) differ. This applies both to light and heavy hydrogen (deuterium). This fact can be used to occupy only states with $m_j = +1/_2$. So, these atoms have a shell polarization which is transmitted to the nucleus in the course of an adiabatic transition into a weak magnetic field (approximately 2 Oe). Charge exchange reactions are used for the selective ionization of these polarized atoms in the $2S^1/_2$ state. To allow high polarization to be achieved, the cross section for the charge exchange with metastable atoms must be as large as possible relative to the cross section of the charge conversion of atoms in the ground state. (auth)

Atomic and Molecular Properties

Refer also to abstracts 417, 1856, 1857, 1883, and 1884.

1814 DETERMINATION OF m, e/m, AND M_p/m BY THE STUDY OF THE ISOTOPE STRUCTURE IN HYDROGEN. George, S. (Department of Physics–Astronomy, California State University, Long Beach, California 90840). Am. J. Phys. 43: No. 10, 885-887 (Oct 1975).

Using a commercially available hydrogen–deuterium light source and a 3.4-m Ebert plane grating spectrograph, the wavelengths of the first six pairs of the Balmer series are obtained. From the results, first, the series limit, Rydberg constant, and ionization potential of hydrogen are found from the graph. Then, by means of formulas involving wave numbers of hydrogen and deuterium and by knowing the Faraday constant, the values of m, e/m, and M_p/m are determined. All the values are found to be in good agreement with accepted values. From the results, this experiment is recommended for an upper division optics and spectroscopy or quantum physics laboratory. (auth)

1815 GROUND STATE AND ELASTIC PHASE SHIFT OF THE ELECTRON-HYDROGEN SYSTEM STUDIED IN HYPERSPHERICAL COORDINATES. Lin, C.D. (Department of Physics, University of Chicago, Chicago, Illinois 60637. Phys. Rev. A 12: No. 2, 493-497 (Aug 1975)

Using hyperspherical coordinates and adiabatic expansion methods, we obtain the potential curves for the electron-hydrogen system in ^1S states. From the lowest potential curve we compute the ground-state energy of H^- to be -1.0547 Ry. We also compute the elastic scattering phase shifts at low energies from the same potential curve. Results are very good at low energies. The variations of important correlation effects as the system expands are also investigated. (auth)

1816 PHOTODETACHMENT OF NEGATIVE HYDROGEN IONS. Ajmera, M.P.; Chung, K.T. (Department of Physics, North Carolina State University, Raleigh, North Carolina 27607). Phys. Rev. A 12: No. 2, 475-479 (Aug 1975).

The photodetachment cross section of the negative hydrogen ion is calculated for incident photon wavelengths in the range 1130 to 14040 Å. The free-state wave function of the bound-free transition is calculated from the simplified Kohn-Feshbach variational method. The bound-state wave function is given by Rotenberg and Stein, who used the Hylleraas correlated wave function with a "tail function" added to it. The agreement between the results from the length and velocity formulas in the present work is found to be considerably better compared to earlier theoretical results. The overall agreement with experimental results also shows some improvement. The cross section is found to rise and fall sharply in the closed-channel resonance region at the positions of the two singlet P resonances. The shape parameter q is also calculated for each resonance state. (auth)

1817 DIAGRAMMATIC TECHNIQUE FOR CALCULATING MATRIX ELEMENTS OF COLLECTIVE OPERATORS IN SUPERRADIANCE. Lee, C.T. (Department of Physics and Mathematics, Alabama A&M University, Normal, Alabama 35762). Phys. Rev. A 12: No. 2, 575-586 (Aug 1975).

Adopting the so-called "genealogical construction," one can express the eigenstates of collective operators corresponding to a specified mode for an N-atom system in terms of those for an $(N-1)$ -atom system. Using these Dicke states as bases and using the Wigner-Eckart theorem, a matrix element of a collective operator of an arbitrary mode can be written as the product of an m-dependent factor and an m-independent reduced matrix element (RME). A set of recursion formulas for the RME is obtained. A graphical representation of the RME on the branching diagram for binary irreducible representations of permutation groups is then introduced. This gives a simple and systematic way of calculating the RME. This method is especially useful when the cooperation number r is close to $N/2$, where almost exact asymptotic expressions can be obtained easily. The result shows explicitly the geometry dependence of superradiance and the relative importance of r-conserving and r-nonconserving processes. This clears up the chief difficulty encountered in the Dicke-Schwendimann approach to the problem of N two-level atoms, spread over large regions, interacting with a multimode radiation field. (auth)

1818 PROFILE OF THE TWO-PHOTON ABSORPTION LINE DUE TO THE 1S–2S TRANSITION IN ATOMIC HYDROGEN. Baklanov, E.V.; Chebotaev, V.P. (Institute of Semiconductor Physics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk). Sov. J. Quantum Electron. 5: No. 3, 342-344 (Mar 1975).

An analysis is made of the profile of a two-photon absorption line of hydrogen free of the first-order Doppler broadening. The possibility of eliminating the quadratic Doppler effect with the aid of a narrow peak of the second derivative of the line profile is considered. It is shown that for a realistic temperature stability it should be possible to achieve a reproducibility of the order of 10^{-15}. (auth)

1819 TWO-PHOTON IONIZATION OF A METASTABLE HYDROGEN MOLECULE. Davydkin, V.A.; Rapoport, L.P. (Lenin Komsomol State University, Voronezh). Sov. J. Quantum Electron. 5: No. 2, 195-199 (Aug 1975).

A calculation is made of the total two-photon ionization cross section of a metastable hydrogen molecule in the photon energy range 1.85–2.4 eV. The summation over intermediate electron states is made using the electron Green's function, derived in the quantum defect approximation employing a spheroidal coordinate system. An investigation is made of the influence of the nuclear motion in the initial, final and intermediate states. The cases of linear and circular polarization of the incident radiation are considered. (auth)

1820 STEPWISE EXCITATION AND LEVEL-CROSSING SPECTROSCOPY OF THE TRIPLET D STATES OF HELIUM-4. Tam, A.C. (Columbia Radiation Laboratory, Department of Physics, Columbia University, New York, New York 10027). Phys. Rev. A 12: No. 2, 539-550 (Aug 1975).

The fine-structure intervals of the lowest two triplet D states of ^4He have been obtained by a new method: Ground-state atoms are excited by a discharge to the triplet metastable state, which then undergoes a two-step optical excitation to the triplet D states, where level-crossing measurements are made. The experimental results for $^3D_1$-$^3D_3$ (MHz) are 1400.67 ± 0.29 and 591.25 ± 0.14 for the $3\,^3D$ and $4\,^3D$ states, respectively; for $^3D_2$-$^3D_3$ (MHz) they are 75.97 ± 0.23 and 36.15 ± 0.24 for $3\,^3D$ and $4\,^3D$. These values are much more precise than the previously available data, obtained by optical, particle-bombardment level crossing, or beam-foil quantum-beat spectroscopy, and are consistent with the previous data except for one case, where a previous measurement of $3\,^3D_2$-$3\,^3D_3$ by electron bombardment level-crossing

spectroscopy is believed to be in error. These new experimental values for the fine structures of the triplet D states of ^{4}He clearly indicate the inadequateness of existing theoretical calculations of these fine structures. (auth)

1821 ANGULAR CORRELATION OF X RAYS: L-M CASCADES OF PLUTONIUM. Zalutsky, M.R.; Macias, E.S. (Department of Chemistry, Washington University, St. Louis, Missouri 63130). Phys. Rev. A 12: No. 2, 526-530 (Aug 1975).

Angular correlations between L and M x rays in ^{239}Pu obtained from a radioactive source of 32-yr ^{243}Cm were measured using Si(Li) and Ge(Li) detectors. The measured angular-correlation coefficients $A_{22} = (8.5 \pm 1.5) \times 10^{-2}$ for the $L\beta_1$-M cascade and $A_{22} = (7.7 \pm 2.0) \times 10^{-2}$ for the $L\alpha_{1+2}$-M cascade are both significantly higher than theoretical predictions. The intensity of the Pu L_1-L_3 x ray per L_1 vacancy was found to be $I(L_1\text{-}L_3) / \Gamma(L1) = (6.6 \pm 0.8) \times 10^{-2}$. The angular correlation coefficient of the $L\alpha$- (L_1-L_3) x-ray cascade was measured and found to be $A_{22} = (3 \pm 7) \times 10^{-2}$ and is in agreement with theoretical predictions. (auth)

1822 POSSIBILITY OF EXCLUDING A CONTINUOUS SPECTRUM FROM THE CALCULATION OF ELECTRONIC STATES OF A MOLECULAR HYDROGEN ION I. THE STURM EXPANSION OF THE GREEN'S FUNCTION IN TWO-CENTER PROBLEMS. Sherstyuk, A.I. Opt. Spectrosc. (USSR) 38: No. 5, 601-602 (May 1975).

Electronic states of hydrogenlike ions were calculated using Sturm's expansion of the Green's functions. (AIP)

1823 THE REACTION $H_2O^+(D_2,D)H_2DO^+$. Jones, C.A.; Wendell, K.L.; Koski, W.S. (Department of Chemistry, The Johns Hopkins University, Baltimore, Maryland 21218). J. Chem. Phys. 63: No. 5, 2254-2255 (1 Sept 1975).

The reaction $H_2O^+(D_2,D)H_2DO^+$ was studied over an energy range 0.75 to 69 eV using a scattering spectrometer. The results are consistent with previous measurements at higher temperature and it is concluded that the reaction proceeds via a direct mechanism down to energies below 0.14 eV. (AIP)

1824 ON THE EXISTENCE OF BOUND HELIUM TRIMERS BY THE EQUIVALENT TWO-BODY METHOD. Lim, T.K.; Zuniga, M.A. (Department of Physics and Atmospheric Science, Drexel University, Philadelphia, Pennsylvania 19104). J. Chem. Phys. 63: No. 5, 2245-2248 (1 Sept 1975).

The binding energies of the ^{3,4}He trimers are computed for a range of realistic interatomic potentials using the equivalent two-body method of Bodmer and Ali. We find a ^{4}He trimer bound with a binding energy of about 0.25°K and a ^{3}He trimer which is but loosely bound. We also confirm that the Hall–Post–Stenschke method gives poor lower bounds to the energy and that $(^4He)_3$ is large, having a root mean square interparticle spacing of 23 Å. (auth)

1825 DEGENERATE MANY-BODY PERTURBATION THEORY: EXCITED STATES OF H_2. Kaldor, U. (Chemistry Department, Tel Aviv University, Tel Aviv, Israel). J. Chem. Phys. 63: No. 5, 2199-2205 (1 Sept 1975).

The degenerate many-body perturbation theory in Brandow's diagrammatic expansion is applied to 16 excited states of H_2 at two internuclear separations. A single set of molecular orbitals at each separation is used for all states. Energy corrections up to third order (inclusive) are calculated, and higher-order effects are estimated by geometric extrapolation. Results agree with best available values to 1–2 kcal/mole. Differences between Goldstone and Brandow diagrams are discussed. (auth)

1826 INTEGRAL HELLMANN-FEYNMAN ANALYSIS OF NONISOELECTRONIC PROCESSES AND THE DETERMINATION OF LOCAL IONIZATION POTENTIALS. Simons, G. (Department of Chemistry, Wichita State University, Wichita, Kansas 67208). J. Chem. Phys. 63: No. 5, 2206-2210 (1 Sept 1975).

The integral Hellmann-Feynman theorem is extended to apply to nonisoelectronic processes. A local ionization potential formula is proposed, and test calculations on three different approximate helium wavefunctions are reported which suggest that it may be numerically superior to the standard difference of expectation values. Arguments for the physical utility of the new concept are presented, and an integral Hellmann–Feynman analysis of transition energies is begun. (auth)

1827 TETROXO ANIONS OF HEXAVALENT TECHNETIUM AND RHENIUM. Astheimer, L.; Hauck, J.; Schenk, H.J.; Schwochau, K. (Institut für Chemie der Kernforschungsanlage Jülich GmbH, Institut 1: Nuklearchemie, D-517 Jülich, Germany). J. Chem. Phys. 63: No. 5, 1988-1991 (1 Sept 1975).

$[(CH_3)_4N]_2MnO_4$, $[(CH_3)_4N]_2TcO_4$, and $[(CH_3)_4N]_2ReO_4$ are isotypic and crystallize in an antifluoritelike cubic face centered lattice with a=11.09 Å (Mn), 11.20 Å (Tc), and 11.35 Å (Re). The magnetic susceptibilities obey the Curie–Weiss law over the temperature range 77–298 °K with μ_{eff}=1.63 μ_B (Mn), 1.60 μ_B (Tc), and 1.47 μ_B (Re). The magnetic moments of $[(CH_3)_4N]_2TcO_4$ and $[(CH_3)_4N]_2ReO_4$ as well as the splitting and vibrational structure of the $^2E \rightarrow {}^2T_2$ intrashell transition indicate strong Jahn–Teller distortion of TcO_4^{2-} and ReO_4^{2-} in the first excited $^2T_2$ state. Tetrahedral crystal field parameters of $\Delta = -11$ kK, $\Delta = -17$ kK, and $\Delta = -19$ kK are derived for MnO_4^{2-}, TcO_4^{2-}, and ReO_4^{2-}. The electron transfer spectra reflect the lower degree of covalency of the Re–O bond in comparison to the Tc–O and Mn–O bond. (auth)

1828 $\psi_{2,0}$ IN THE FOCK EXPANSION FOR He ^1S STATE WAVEFUNCTIONS. David, C.W. (Department of Chemistry, University of Connecticut, Storrs, Connecticut 06268). J. Chem. Phys. 63: No. 5, 2041-2044 (1 Sept 1975).

The coefficients of $\psi_{2,0}$ in the Fock expansion for ^1S states of two electron atoms and ions are obtained. (auth)

1829 INELASTIC COLLISIONS BETWEEN AN ATOM AND A DIATOMIC MOLECULE. II. H+H_2 ROTATIONAL EXCITATION. Choi, B.H.; Tang, K.T. (Department of Physics, Pacific Lutheran University, Tacoma, Washington 98447). J. Chem. Phys. 63: No. 5, 1783-1796 (1 Sept 1975).

The formulation and the numerical procedure developed in the preceding paper for solving close coupled differential equations in the study of scatterings of diatomic molecules by atoms are applied to rotational excitations of H+H_2 collisions. Converged results are obtained from three different potential functions suggested for this system. In addition to some new results, all previously reported results except one are essentially reproduced. The present close coupling results are drastically different from those of Wolken, Miller, and Karplus obtained using an identical potential. Detailed comparisons between results of close coupling calculation and of the distorted wave Born approximation are made for all three potentials and some general features of DWBA results are discussed. Correlations between genuine differences in cross sections and interaction potentials are found through S-matrix elements which also serve as a test for the accuracy of the calculation. (auth)

1830 DILUTE-IMPURITY HYPERFINE FIELDS IN Fe, Co, Ni, AND Gd. Rao, G. N. (Inst. fuer Strahlen- und Kernphysik der Univ., Bonn). At. Data Nucl. Data Tables; 15: No. 6, 553-576(Jun 1975).

All the available experimental data on the hyperfine fields in the ferromagnetic hosts of Fe, Co, Ni, and Gd have been collected and tabulated. The best values for dilute-impurity hyperfine fields in Fe, Co, and Ni hosts are plotted as functions of the solute atomic number. Some useful relations of the curves to impurity electronic configurations are pointed out. (auth)

1831 STARK BROADENING OF N II AND N III LINES. Popovic, M. V.; Platisa, M.; Konjevic, N. (Inst. of Physics, Belgrade). Astron. Astrophys.; 41: No. 3-4, 463-465(Jul 1975).

A pulsed low-pressure arc was the source of a plasma used to measure, on a shot-to-shot basis, profiles of 9 lines of singly ionized and 5 lines of doubly ionized nitrogen. An electron density of 4.8 and 5.5×10^{18} cm^{-3} was determined by laser interferometry while electron temperatures 23150 K and 24300 K were measured using the relative intensities of N II lines. The experimental N II Stark profile half-widths agree well with theory. (auth)

1832 PROBLEM OF PARITY NONCONSERVATION IN FORBIDDEN ATOMIC TRANSITIONS. Khriplovich, I. B. (Inst. of Nuclear Physics, Moscow). Yadern. Fiz.; 21: No. 5, 1046-1051(May 1975). (In Russian)

Mechanism of the forbidden M1 transition 6s–7s in cesium is discussed. The contribution from relativistic effects to the transition and to the g-factor of the valent electron is calculated. It is shown that the 6s–7s transition proceeds mainly due to configuration mixing. As a result of the weak parity-violating eN interaction, a circular polarization of the photons may arise in this transition with the magnitude of about 10^{-4}. Atomic transitions in which somewhat larger effects of the parity nonconservation may occur are indicated. (auth)

1833 DETERMINATION OF ATOMIC SCREENING PARAMETERS. Brandus, L. (Inst. of Physics, Bucharest). Rev. Roum. Phys.; 20: No. 4, 341-349(1975).

The atomic screening parameters for helium to argon atoms are determined. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstract 129.

1834 (JINR-P4-8835) WAVE FUNCTIONS AND LEVEL ENERGIES OF π-MESIC ATOMS. Arsen'ev, D. A.; Bunatyan, G. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1975. 23p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The π-mesic atom states have been studied for some nuclei in detail. The interaction of the π-meson with nucleus is described

by the effective quasipotential used rather effectively for the description of known experimental data on π-mesic atoms. The dependence of energies E_{nl}, level widths Γ_{nl} and wave functions Φ_{nl} on the orbital momentum of π-meson both for strongly (with small n) and weakly (with high n) bounded states for various nuclei has been studied. The investigation has been performed at the Laboratory of Theoretical Physics, JINR. (auth)

1835 TEST OF QUANTUM ELECTRODYNAMICS BY MUONIC ATOMS: AN EXPERIMENTAL CONTRIBUTION. Tauscher, L.; Backenstoss, G.; Fransson, K.; Koch, H.; Nilsson, A.; De Raedt, J. (CERN, Geneva, Switzerland, Phys. Rev. Lett. 35: No. 7, 410-412 (18 Aug 1975).

The large unexplained deviations of the experimental muonic 4—3 transitions in Ba and 5—4 transitions in Pb from calculations were found not to be existent. The absolute energies of these transitions agree, on the average, with theory to within 10 eV: The differences between experimental and calculated energies $E^{calc.}$-E^{exp} are $+2\pm13$ and -2 ± 12 eV for the μ^-—Ba $4f_{5/2}-3d_{3/2}$ and $4f_{7/2}-3d_{5/2}$ transitions, respectively, and 10 ± 16 and -13 ± 14 eV for the μ^-—Pb $5g_{7/2}-4f_{5/2}$ and $5g_{9/2}-4f_{7/2}$ transitions, respectively. (auth)

1836 POSITRON ANNIHILATION IN NITRIC OXIDE AND NITROGEN DIOXIDE. Tao, S. J.; Chuang, S. Y.; Wilkenfeld, J. (New England Inst., Ridgefield, CT). (Phys. Rev., A; 6: No. 5, 1967-1973(Nov 1972).

Positron-annihilation lifetimes in nitrogen dioxide and nitric oxide gases are carefully determined. Nitrogen is used as a dilutant. The free-positron-annihilation rate in units of the effective number of electrons per molecule Z/sub eff/ for nitrogen dioxide as a mixture of dimers and monomers is determined to be 720 to 1090 and the free-positron-annihilation rate for nitric oxide is Z/sub eff/ equals 34. The positronium quenching rate in nitrogen dioxide gas is very high, and the conversion reaction by NO_2 is found to be mainly responsible for the quenching. The quenching rate is determined to be 460D $nsec^{-1}$ $amagat^{-1}$, where D is the partial density. The positronium quenching rate in nitric oxide is determined to be only about 0.15D $nsec^{-1}$ $amagat^{-1}$, and it changes with the concentration of nitrogen. (auth)

Collision Phenomena

Refer also to abstracts 1815 and 1829.

1837 (AD/A—003687) THEORETICAL CONSIDERATIONS OF POTENTIAL ENERGY SURFACES FOR ION—MOLECULE REACTIONS. Kaufman, J. J. (Johns Hopkins Univ., Baltimore, Md. (USA). Dept. of Chemistry). Aug 1974. Contract F44620-69-C0110. 33p. NTIS $3.75.

A general formulation for potential energy surfaces for ion-molecule reactions is presented in terms of the symmetry and spin restrictions for permitted intermediates from reactants and for what electronic states of the products such intermediates can dissociate to. Large scale ab-initio configuration interaction calculations of the $O(+) + N_2$ to $NO(+) + N$ reaction convincingly confirmed the mechanism postulated on the basis of the symmetry and spin restrictions. This treatment was generalized successfully to the case of molecular decompositions and confirmed calculationally. Further examples of ab-initio configuration interaction calculations are presented for the $C(+) + H_2$ system and for the excited states of $H_2O(+)$. The symmetry and spin formulation of potential energy surfaces is completely general and applicable to all reactive and non-reactive collisions including electronically or vibrationally excited chemical lasers, atmospheric phenomena, hot atom chemistry and chemical kinetics. (GRA)

1838 (AD/A—004074) ELECTRONIC EXCITATION IN COLLISIONS OF H AND H^+ WITH O_2. Birely, J. H. (Aerospace Corp., El Segundo, Calif. (USA)). 27 Dec 1974. Contract F04701-74-C-0075. 31p. NTIS $3.75.

The 115-750 nm radiation produced in collisions of 1.5-25 keV $H(+)$ and H with O_2 has been studied in an atomic beam experiment under thin-target conditions. Both for ion and neutral impact, the first negative (1N) and second negative (2N) band systems of $O_2(+)$ are the most intense spectral features. Also observed are several emissions from excited states of O and $O(+)$. Relative cross sections for individual bands of the $O_2(+)$1N system were used to show that the vibrational population formed in both $H(+)$ and H impact is in good agreement with the predictions of a simple Franck-Condon mechanism over the 2-25 keV energy range. Total cross sections for formation of $O_2(+)$ electronic states are discussed. (GRA)

1839 (COO--2431-2) M.I.T. FUSION TECHNOLOGY PROGRAM. Technical Progress Report, 1 July 1974--30 April 1975. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). 30 Jun 1975. 145p. Dep. NTIS $10.25.

Research under this contract has dealt with the following tasks, (1) simulation of radiation effects in fusion materials, (2) critical evaluation of fusion reactor development, (3) fusion-fission symbiosis, (4) 14-MeV neutron source development, (5) pellet fueling of fusion reactors, and (6) thermal design of fusion reactor systems. Discussions are given for each. (MOW)

1840 (UCID-16844) PHOTODETACHMENT OF ELECTRONS FROM NEGATIVE IONS IN A 200-keV NEUTRAL DEUTERIUM-BEAM SOURCE. Fink, J. H.; Frank, A. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Jul 1975. 8p. Dep. NTIS $4.00.

Photodetachment of electrons from negative ions is analyzed, showing how laser technology can enhance high energy neutral beam production. In particular, the performance of a 200-keV neutral beam source is analyzed using commercially available gallium-arsenide solid state lasers. The prospects for the development of an efficient system are good. (auth)

1841 ELASTIC ELECTRON-NEUTRAL INTERACTION MEASUREMENTS IN NEON AT ULTRALOW ENERGIES. Sol, C.; Devos, F.; Gauthier, J. (Groupe d'Electronique dans les Gaz, Institut d'Electronique Fondamentale, Laboratoire associé au Centre National de la Recherche Scientifique, Bâtiment 220, Université Paris-XI-91405, Orsay, France). Phys. Rev. A 12: No. 2, 502-507 (Aug 1975).

The cross section σ_{MT} for the elastic momentum transfer of electrons with neon atoms in the electron energy range $3 \times 10^{-3} \leq u$ (eV) $\leq 5 \times 10^{-1}$ has been deduced from measurements of the microwave absorptivity of a transient cryogenic afterglow plasma. A least-squares fit of our experimental data by the modified effective range formula gives a zero-energy scattering length of (0.24 ± 0.015) a_0, where a_0 is the Bohr radius. (auth)

1842 RECOIL EFFECTS ON THE IMPACT-PARAMETER DEPENDENCE OF X—RAY PRODUCTION IN HEAVY-ION COLLISIONS. Burch, D. (Department of Physics, University of Washington, Seattle, Washington 98195); Taulbjerg, K. Phys. Rev. A 12: No. 2, 508-514 (Aug 1975).

Inner-shell vacancy production in the target recoil interaction can distort the observed impact-parameter dependence of x-ray production in heavy-ion collisions when measured in thin-foil targets. Approximate expressions are presented for the energy and scattering-angle dependence of the recoil contribution. A numerical example is given for Al *K*-x-ray production in Al foils. The recoil correction is estimated for *L*-x-ray production in I + Te collisions and compared with the data of Stein *et al.*; the unexpected rise in the probability they observed at small impact parameters could possibly be accounted for by this mechanism. (auth)

1843 RIGOROUS METHOD FOR COMPUTING PHOTOABSORPTION CROSS SECTIONS FROM A BASIS-SET EXPANSION. Rescigno, T.N.; McKoy, V. (Arthur Amos Noyes Laboratory of Chemical Physics, California Institute of Technology, Pasadena, California 91125). Phys. Rev. A 12: No. 2, 522-525 (Aug 1975).

We present a rigorous technique, which should be applicable to both atoms and molecules, for calculating photoabsorption cross sections using square-integrable basis functions. The technique is based on the method of complex coordinates as developed by Nuttall and co-workers. In contrast to some other L^2 methods, the calculations converge directly at real energies. The method is illustrated by application to the case of atomic hydrogen. (auth)

1844 TWO-POTENTIAL EIKONAL APPROXIMATION FOR ELECTRON-ATOM COLLISIONS. Ishihara, T.; Chen, J.C.Y. (Department of Physics and Institute for Pure and Applied Physical Sciences, University of California at San Diego, La Jolla, California 92037). Phys. Rev. A 12: No. 2, 370-374 (Aug 1975).

The Glauber approximation is known to be in appreciable error at all angles when applied to the elastic electron-atom scattering at medium and lower energies. It is shown that this is not due to the frozen-target approximation but mainly a result of the inadequate semiclassical treatment of close-encounter collisions in the Glauber approximation. A simple method is proposed to correct this inadequacy and is applied to e-H elastic scattering at energies from 20 to 100 eV. A remarkable improvement over the Glauber approximation is obtained, and the results agree with experiments very well at all angles where measurements are available. (auth)

1845 EFFECT OF EXCESSIVE-TRAPPING OPERATION OF SEQUENTIAL MASS SPECTROMETERS SHOWN FOR COLLISION CROSS-SECTION DATA OF BCl_3. Hafidh, Z.A.; Hartnagel, H.L. (Department of Electrical and Electronic Engineering, University of Newcastle Upon Tyne, The Merz Laboratories, Newcastle Upon Tyne, NE1 7RU, U. K.). J. Vac. Sci. Technol. 12: No. 5, 1067-1071 (Sept 1975).

The transients of ion trapping were studied in sequential mass spectrometers. The optimization criteria of the trap are very complex and are dependent on such parameters as the mass of the trapped ions.

A new calibration scheme was developed for the measurement of the collision cross section of unknown gases and was applied to BCl_3, which is commonly used for boron-ion implantation into silicon. (auth)

1846 ADDITIONAL RESONANCES IN ELECTRON SCATTERING BY ATOMIC OXYGEN. Spence, D. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. A 12: No. 2, 721-724 (Aug 1975).

Four new resonances, located at 10.73, 12.55, 14.40, and 15.65 eV, are observed in electron scattering by atomic oxygen. Two of these resonances, located at 10.73 and 15.65 eV, have been predicted theoretically to occur at 10.63 $[(^4S)3p^2\ ^6P]$ and 15.75 eV $[(^2P)3p^2\ ^4D]$, respectively. We attribute the two other resonances at 12.55 eV and 14.40 eV, to the configurations $(^2D)3s3p$ and $(^2P)3s3p$. With the addition of these new identifications, a total of ten resonances are now known to occur in atomic oxygen, completing the triad of resonance configurations, $3s^2$, $3s3p$, and $3p^2$, associated with each of the three lowest (^4S, ^2D, ^2P) positive ion states. (auth)

1847 ROTATIONAL EXCITATION OF SYMMETRIC-TOP MOLECULAR IONS BY ELECTRON IMPACT. Chu, S. (Joint Institute for Laboratory Astrophysics, University of Colorado and National Bureau of Standards, Boulder, Colorado 80302). Phys. Rev. A 12: No. 2, 396-405 (Aug 1975).

The theory for the rotational excitation of symmetric-top molecular ions by electron impact is formulated within the Coulomb-Born approximation. Analytical expressions are derived for the rotational transitions induced by dipole and by quadrupole interactions. The cross sections are large and finite at threshold and decrease with increasing electron-impact energy. The validity of the present theory for the description of low-energy collisions is examined. Numerical calculations are reported for the excitation of the hydronium H_3O^+ ion. (auth)

1848 A MANY-BODY TREATMENT OF FESHBACH THEORY APPLIED TO ELECTRON-ATOM AND ELECTRON-MOLECULE COLLISIONS. McCurdy, C.W. Jr.; Rescigno, T.N.; McKoy, V. (Arthur Amos Noyes Laboratory of Chemical Physics, California Institute of Technology, Pasadena, California 91125). Phys. Rev. A 12: No. 2, 406-412 (Aug 1975).

The Feshbach projection-operator technique is investigated using second quantization to construct approximate optical potentials with Tamm-Dancoff–approximation and random-phase–approximation descriptions for closed-shell targets. We interpret a recent many-body theory of elastic scattering (due to Schneider, Taylor, and Yaris) as an approximate form of the equations of this work. Possible applications and extensions of the method are also described. (auth)

1849 RESONANCE-CHANNEL QUANTUM NUMBERS IN ELECTRON-HYDROGEN AND PROTON-HYDROGEN SCATTERING FROM GROUP THEORY OF THE LONG-RANGE DIPOLE INTERACTION. Herrick, D.R. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. A 12: No. 2, 413-424 (Aug 1975).

We derive quantum numbers K and T which label asymptotic potential-energy curves in e^--H scattering. Zero-order channel states are constructed group theoretically so that the dipole interaction $r_1 \cos\theta_{12}$ is diagonal in a product space of hydrogenic orbitals for 1 and spherical harmonics for 2. K and T are analogous to the "electric quantum number" and the z component of angular momentum in the linear Stark effect for H, and are closely related to quantum numbers described recently for doubly excited He. Channels supporting resonances are predicted from a perturbation expansion of eigenvalues of the effective centrifugal barrier operator $2r_1 \cos\theta_{12} + l_2^2$ in terms of K and T. Comparison with exact H^- results and experiment is excellent, and the method accounts for previously unexplained degeneracies with respect to total parity. A rigorous result is that only channels with $K > 0$ can support an infinity of states below threshold. An approximate selection rule for coupling between neighboring channels suggests that decay of H^- resonances goes preferentially to channels such that $\Delta K = \pm 1$, $\Delta T = 0$. Application of the method is also made to p-H scattering channels for which the zero-order basis nearly diagonalizes the long-range centrifugal barrier. (auth)

1850 CHARACTERISTIC AND CONTINUUM X RAYS PRODUCED WITH POTASSIUM IONS OF A FEW MeV. Brown, L.; Assousa, G.E.; Thonnard, N. (Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, D. C. 20015); Van Rinsvelt, H.A.; Kumar, C.K. Phys. Rev. A 12: No. 2, 425-433 (Aug 1975).

We report observations of x radiation from 1.0 to 4.5 keV produced by the collision of K^+ ions of 0.5 to 3.0 MeV with thick targets. Characteristic lines of the beam or the target or both are observed, depending on the target. These lines are superimposed on a continuum that is exponential in form. The relative dependence of the line yields on atomic number and the continuum on photon energy can be reproduced without the use of an adjustable parameter, if one assumes that the processes are controlled by the Fourier spectrum experienced by an orbital electron that results from the passage of a uniformly moving charged particle. A mechanism is proposed that allows this control to function in producing K-shell vacancies. The formulas are applied to other data and are shown to reproduce the relative Z dependence for projectiles of 0.01 to 2.5 MeV/amu with Z_1 ranging from 17 to 82. (auth)

1851 ELECTRON CAPTURE INTO EXCITED STATES OF HELIUM BY HELIUM-ION IMPACT ON HELIUM. Winter, T.G. (Department of Physics, Rice University, Houston, Texas 77001); Lin, C.C. Phys. Rev. A 12: No. 2, 434-443 (Aug 1975).

Cross sections for electron capture into each excited state of He up to $4\,^{1,3}D$ by He^+ impact on He in the energy range 100–10 000 keV have been calculated by means of the first Born approximation (Bates's version). A Gaussian technique previously developed for evaluating two-center integrals occurring in the Born amplitude has been used. One-parameter, variational wave functions are derived for each excited state of helium up to $4\,^{1,3}D$. Some of the excited ^1S cross sections are found to be affected by almost a factor of 2 by the choice of $1\,^1S$ helium wave function and orthogonality of the excited state ^1S functions to this function. The observed departure of the ratio of triplet to singlet cross sections from the statistical weight of three is related partly to the interference between a one-electron process of capture into an excited state of helium and a two-electron process of capture into the ground state with the original He^+ electron excited, and is related partly to the difference between the variational singlet and triplet excited one-electron wave functions. At energies of about 100 keV, agreement with available experimental results is generally good; however, for the $3\,^1P$, $4\,^1P$, and $4\,^1D$ states, the disagreement exceeds the estimated experimental uncertainty. (auth)

1852 VARIATIONAL CALCULATIONS OF ELECTRON IMPACT EXCITATION OF He NEAR THE $2\,^3S$ AND $2\,^1S$ THRESHOLDS. Nesbet, R.K. (IBM Research Laboratory, San Jose, California 95193). Phys. Rev. A 12: No. 2, 444-450 (Aug 1975).

Matrix variational calculations, reported previously, of e-He inelastic scattering, have been extended into the near-threshold regions for excitation of the metastable states $2\,^3S$ and $2\,^1S$. Wigner cusp and rounded-step structures are computed at these thresholds for elastic and inelastic processes not involving the threshold channels. Excitation cross sections are computed for the threshold channels. The present computed results are compared with available experimental data, and found to be in general qualitative and quantitative agreement. A new estimate is derived of the rate coefficient for deactivation of $He(2\,^3S)$ by thermal electrons: a constant value 2.525×10^{-9} cm^3/sec for $T \leq 1053$ °K. (auth)

1853 MEASUREMENT OF CROSS SECTIONS FOR EXCITATION OF THE 2P STATES OF ATOMIC HYDROGEN BY CHARGE-EXCHANGE COLLISIONS OF PROTONS IN ARGON AND NITROGEN. Suchannek, R.G.; Sheridan, J.R. (Geophysical Institute, University of Alaska, Fairbanks, Alaska 99701). Phys. Rev. A 12: No. 2, 460-467 (Aug 1975).

Absolute cross sections for the excitation of the $2P$ states of atomic hydrogen in charge-exchange collisions of protons in argon and nitrogen were measured by observing the Lyman-α radiation emitted in transitions from this state. Because of the lack of light standards in the vacuum ultraviolet region of the spectrum, the major problem of the measurements was the absolute calibration of the Lyman-α photometer. This calibration was obtained from coincidence measurements of H_α and Lyman-α photons in the presence of an electric field. The measurements were corrected for the effect of Doppler shift on the photometer sensitivity. For the evaluation of the coincidence measurements, the branching ratio of H_α transitions to the $2S$ state and the polarization of Lyman-α radiation, emitted in cascade processes, were needed. These quantities were obtained from quantum-mechanical calculations for a hydrogen atom in a weak electric field. Cross sections for the $2P$ states were obtained in the energy range from 0.5 to 30 keV. The $2P$ cross sections in argon had maxima of 2.34×10^{-17} and 2.84×10^{-17} cm^2 at 3.35 and 11.86 keV, respectively, and in N_2 maxima of 2.17×10^{-17} and 2.10×10^{-17} were observed at 3.39 and 11.3 keV, respectively. The energy dependence of the measured cross sections is in agreement with that of published measurements. Differences in the absolute values are discussed. (auth)

1854 RELAXATION OF A DIP IN THE ATOMIC VELOCITY DISTRIBUTION DUE TO ELASTIC COLLISIONS. Burshtein, A.I.; Kofman, A.G. (Institute of Chemical Kinetics and Combustion, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk). Sov. J. Quantum Electron. 5: No. 3, 274-278 (Mar 1975).

A calculation is made of the relaxation kinetics of a dip formed in a luminescence line of a gas by a short laser pulse. If the initial width of the dip Δ_h is much less than the quantity $k\delta$ (δ is the characteristic scale of the change in the velocity in a collision and k is the modulus of the wave vector), the relaxation kinetics of the dip depth is exponential. An analysis of the kinetics makes it possible to determine the total cross section of the elastic collisions which alter the velocity. In the opposite case of $\Delta_h > k\delta$, the dip depth decreases in accordance with the power law and the center of the dip moves toward the line

center; in principle, this can be used to determine by two independent methods the frequency of the velocity-changing collisions and the corresponding transport scattering cross section. (auth)

1855 EXCITATION OF THE $B\,^3\Pi_g$ STATES OF N_2 BY ELECTRON IMPACT. Chen, S.T.; Anderson, R.J. (Department of Physics, University of Arkansas, Fayetteville, Arkansas 72701). Phys. Rev. A 12: No. 2, 468-474 (Aug 1975).

Radiative lifetime measurements of 13 vibrational levels of the $B\,^3\Pi_g$ state of N_2 have been obtained at 50 eV incident electron energy and 30 mTorr N_2 gas pressure using a 50-μsec electron excitation pulse. Two radiative decay components with lifetimes of approximately 5 and 25 μsec are observed in each case. The short-lived component is identified as the contribution from direct excitation of the $B\,^3\Pi_g$ state. The long-lived cascade contribution is observed to decrease from 37% of the total $B\,^3\Pi_g \rightarrow A\,^3\Sigma_u^+(v, v')$ radiation for the $v = 0$ vibrational level to 15% for the $v = 12$ level and is consistent with theoretical predictions by Cartwright *et al.* (auth)

1856 ELASTIC SCATTERING OF ELECTRONS BY HYDROGEN MOLECULES USING THE EIKONAL APPROXIMATION. Bhattacharyya, P.K. (Department of Physics, University College of Science, University of Calcutta, 92 Acharya P.C. Road, Calcutta-700009, India); Ghosh, A.S. Phys. Rev. A 12: No. 2, 480-485 (Aug 1975).

The eikonal approximation has been used to investigate the elastic scattering of electrons by hydrogen molecules. In addition to the static potential, the effects of polarization and exchange have been included through potentials. The total and the differential cross sections have been calculated in the energy range 9.4–100.0 eV and compared with the experimental and other theoretical values. It is found that the eikonal approximation predicts reliable results for incident electron energies $\gtrsim 20.0$ eV. (auth)

1857 LIMITATIONS OF THE METHOD OF COMPLEX BASIS FUNCTIONS. Baumel, R.T.; Crocker, M.C.; Nuttall, J. (Department of Physics, University of Western Ontario, London, Ontario, Canada). Phys. Rev. A 12: No. 2, 486-492 (Aug 1975).

The method of complex basis functions proposed by Rescigno and Reinhardt is applied to the calculation of the amplitude in a model problem which can be treated analytically. It is found for an important class of potentials, including some of infinite range and also the square well, that the method does not provide a converging sequence of approximations. However, in some cases, approximations of relatively low order might be close to the correct result. The method is also applied to *S*-wave *e*-H elastic scattering above the ionization threshold, and spurious "convergence" to the wrong result is found. A procedure which might overcome the difficulties of the method is proposed. (auth)

1858 EXCITATION COLLISIONS OF STRONTIUM IONS WITH INERT GASES. Zapesochnyi, I.P.; Ovchinnikov, V.L.; Shpenik, O.B. (Uzhgorod State University). Sov. Phys.–Tech. Phys. 20: No. 1, 47-50 (July 1975).

Excitation processes have been studied in collisions of Sr^+ ions with inert-gas atoms over the energy range 10–2500 eV and in the spectral range 3000–7800 Å. The emission spectra of the interacting particles and the excitation functions of the most intense spectral lines are studied and the absolute values of the excitation cross sections are determined. (auth)

1859 PROFILE OF THE ABSORPTION LINE OF ATOMS IN METASTABLE STATES EXCITED BY ELECTRON IMPACT IN AN ATOMIC BEAM. Rakhovskii, V.I.; Shustryakov, V.M. Opt. Spectrosc. (USSR) 38: No. 5, 603-604 (May 1975).

A calculation of the profile of absorption line for light absorbed by metastable atoms excited in an atomic beam is presented. The absorption line profile is used to determine the effective cross sections for the excitation of metastable states. (AIP)

1860 DISSOCIATIVE EXCITATION OF HCN BY SLOW ELECTRONS IN THE 280–700-nm REGION. Korol, V.I.; Kishko, S.M. Opt. Spectrosc. (USSR) 38: No. 5, 486-487 (May 1975).

Emission spectra of the decay products of HCN molecules excited by slow electrons were obtained in the 280–700-nm region at a pressure of 4.5×10^{-4} Torr. Absolute magnitudes of the effective excitation cross sections were determined for seven bands of the violet system ($B^2\Sigma^+ \rightarrow X^2\Sigma^+$) and six bands of the red system ($A^2\Pi \rightarrow X^2\Sigma^+$) of the CN radical, and for two CN^+ bands ($c\Sigma \rightarrow a\Sigma$). The absolute cross sections for excitation of these bands have values between 0.1×10^{-18} cm^2 and 32.8×10^{-18} cm^2 at the maxima. (auth)

1861 POLARIZED-PHOTON, SCATTERED-ATOM COINCIDENCE MEASUREMENTS IN He^+-He COLLISIONS. Jaecks, D.H.; Eriksen, F.J.; de Rijk, W.; Macek, J. (Behlen Laboratory of Physics, University of Nebraska-Lincoln, Lincoln, Nebraska 68508). Phys. Rev. Lett. 35: No. 11, 723-725 (15 Sept 1975).

Photon-scattered-atom coincidence measurements with polarization analysis of the photons have been made for 3.0-keV He^+–He collisions leading to $He(3\,^3P)$ excitation in a charge-transfer process. The phase difference between the scattering amplitudes for $m_l=0$ and $m_l=1$ magnetic sublevel formation is an approximately constant function of scattering angle. We propose a theory which predicts the constancy of this phase difference. (auth)

1862 ANOMALOUS VIBRATIONAL-STATE DISTRIBUTION IN N_2^+ ($B^2\Sigma_u^+$) AFTER CHARGE EXCHANGE OF He_2^+ WITH N_2. Leventhal, J.J.; Earl, J.D.; Harris, H.H. (University of Missouri at St. Louis, St. Louis, Missouri 63121). Phys. Rev. Lett. 35: No. 11, 719-722 (15 Sept 1975).

We measure cross sections for $N_2^+(B^2\Sigma_u^+)$ production in 5-eV He_2^+-N_2 and He^+-N_2 collisions by observation of emission in the first negative system of N_2^+. For He_2^+ the cross section is unusually large (~ 10 Å^2) and the vibrational-state distribution shows primarily $v'=0$ and 1, consistent with vertical ionization of N_2. He^+ produces a much wider distribution, as do most other simple ions. Explanations for the large cross section and observed state distributions are proposed. (auth)

1863 INELASTIC COLLISIONS BETWEEN AN ATOM AND A DIATOMIC MOLECULE. I. THEORETICAL AND NUMERICAL CONSIDERATIONS FOR THE CLOSE COUPLING APPROXIMATION. Choi, B.H.; Tang, K.T. (Department of Physics, Pacific Lutheran University, Tacoma, Washington 98447). J. Chem. Phys. 63: No. 5, 1775-1782 (1 Sept 1975).

The close coupled differential equations for rotational excitation in collisions between an atom and a diatomic molecule are reformulated. Although it is equivalent to other formulations, it is computationally more convenient and gives a simpler expression for differential cross sections. Questions concerning real boundary conditions and the unitarity of the *S* matrix are discussed. Stormer's algorithm for solving coupled differential equations is introduced for molecular scatterings. This numerical procedure, which is known to be very useful in nuclear scattering problems, has to be modified for molecular systems. It is capable of treating the case where all channels are open as well as the case where some of the channels are closed. This algorithm is compared with other typical procedures of solving coupled differential equations. (auth)

1864 NEGATIVE ION FORMATION, VIBRATIONAL EXCITATION, AND TRANSMISSION SPECTROSCOPY IN HYDROGEN HALIDES. Ziesel, J.P.; Nenner, I.; Schulz, G.J. (Department of Engineering and Applied Science, Mason Laboratory, Yale University, New Haven, Connecticut 06520). J. Chem. Phys. 63: No. 5, 1943-1949 (1 Sept 1975).

Three independent experiments are performed in order to elucidate low-energy electron collisions on hydrogen halides. The formation of Cl^- and Br^- shows a steep onset near threshold and structure at higher energies. This structure occurs at the energies of vibrational levels of the $X\,^1\Sigma^+$ ground state of the hydrogen halide. The transmission spectrum of HBr shows structure at the position of the $v=1$ level of the $X\,^1\Sigma^+$ state. In addition, transmission spectra show that the vibrational cross section to $v=1$ in all the hydrogen halides rises steeply near threshold and levels off about 60 meV above threshold. A trapped-electron experiment in HCl substantiates this observation and in addition, gives the order of magnitude of the vibrational cross section near threshold (2×10^{-16}–2×10^{-15} cm^2). (auth)

1865 ELECTRON IMPACT EXCITATION OF THE $1\,^1S \rightarrow 2\,^3S$ TRANSITION IN HELIUM; DIFFERENTIAL CROSS-SECTION DETERMINATIONS AT HIGH INCIDENT KINETIC ENERGIES. Dillon, M.A. (Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213). J. Chem. Phys. 63: No. 5, 2035-2040 (1 Sept 1975).

Differential cross sections have been determined to within ±8% accuracy for the $1\,^1S \rightarrow 2\,^3S$ transition in helium at 200, 300, 400, and 500 eV incident electron energies and scattering angles out to 35°. Relative measurements were made absolute by both direct and indirect normalization to highly precise elastic differential cross sections. Serious deviations from the predictions of first-order plane wave theory are found throughout the range of experimental parameters employed in the present work. Further consideration suggests that such discrepancies persist to incident energies as high as 1000 eV raising serious doubts about the validity of the Born–Oppenheimer approximation. (auth)

1866 VALIDITY OF CENTRAL FIELD APPROXIMATIONS IN MOLECULAR SCATTERING: LOW ENERGY CO–He COLLISIONS. Monchick, L. (The Applied Physics Laboratory, The Johns Hopkins University, Silver Spring, Maryland 20910); Green, S. J. Chem. Phys. 63: No. 5, 2000-2009 (1 Sept 1975).

Close coupled calculations have been carried out on collisions of helium and carbon monoxide interacting via a theoretical interaction potential which is believed to accurately reproduce the true interaction of this system. These are compared with an equivalent set of calculations for the spherical average of this potential, V_0. We conclude that the latter approximation holds reasonably well for transport property calculations but not for differential and total scattering cross sections. As a consequence, conservation of scattering cross section theorems that are based on V_0 do not hold well. (auth)

1867 DIFFERENTIAL CROSS SECTIONS FOR ELASTIC ELECTRON SCATTERING. III. THE C_2H_2, C_2H_4, AND C_2H_6 RESULTS. Fink, M. (Physics Department and Electronics Research Center, University of Texas, Austin, Texas 78712); Jost, K.; Herrmann, D. J. Chem. Phys. 63: No. 5, 1985-1987 (1 Sept 1975).

Relative elastic differential cross sections for electrons scattered from C_2H_6, C_2H_4, and C_2H_2 have been measured for angles between 3 and 130 deg and electron energies between 100 and 1000 eV. The data agree very well, for angles larger than 40 deg, with calculations in the independent atom model approximation and partial wave atomic scattering factors. The results show strong charge cloud polarization effects at small angles and low energies. At higher energies the molecular binding effects cause the cross sections to fall below the calculated results. (auth)

1868 SENSITIZED FLUORESCENCE IN CROSSED ATOMIC BEAMS: $Hg(6\,^3P_{0,2})+Tl(6\,^2P_{1/2})$. Loh, L.C.; Sholeen, C.M.; Herm, R.R. (Inorganic Materials Research Division, Lawrence Berkeley Laboratory and Department of Chemistry, University of California, Berkeley, California 94720); Parrish, D.D. J. Chem. Phys. 63: No. 5, 1980-1984 (1 Sept 1975).

A velocity selected Tl beam has been crossed by an electron-bombarded Hg beam which contains a small percentage of the $Hg(6\,^3P)$ metastable levels (an approximate 5:1 ratio of $^3P_2$:$^3P_0$). By means of an interference filter–photomultiplier combination beneath the collision zone, the cross section for excitation of the 5350 Å $(7\,^2S_{1/2} \rightarrow 6\,^2P_{3/2})$Tl fluorescence has been determined to increase monotonically with decreasing relative collision speed, g, approximately as g^{-s} for $s=2.0\pm0.5$. Implications of these results for the sensitized fluorescence phenomenon in vapor mixtures of metallic elements are briefly discussed. (auth)

1869 APPROXIMATIONS FOR THE ROTATIONAL EXCITATION OF MOLECULES BY ATOMS. Chu, S.; Dalgarno, A. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory, Cambridge, Massachusetts 02138). J. Chem. Phys. 63: No. 5, 2115-2118 (1 Sept 1975).

The applicability of the effective close-coupling approximation of Rabitz and the centrifugal decoupling approximation of McGuire and Kouri is examined for a system which models the rotational excitation of molecular nitrogen in collisions with helium atoms. For small values of the rotational quantum number both methods are more accurate for total elastic scattering cross sections than for inelastic and neither is capable of providing reliable inelastic cross sections close to the rotational threshold. Agreement with the close-coupling cross sections improves with increasing impact energy. The accuracy of the centrifugal decoupling approximation appears to be stable with respect to the magnitude of the repulsive anisotropy whereas the effective close-coupling method is sensitive to it and the approximation becomes inaccurate when the anisotropy is large. The detailed-balancing relationship is not satisfied by the effective close-coupling method and modifications that depend upon energy and upon the magnitude of the anisotropy are needed. (auth)

1870 NUMERICAL COMPARISON BETWEEN ELECTRONICALLY ADIABATIC AND DIABATIC REPRESENTATIONS FOR COLLINEAR ATOM–DIATOM COLLISIONS. Zimmerman, I.H.; George, T.F. (Department of Chemistry, The University of Rochester, Rochester, New York 14627). J. Chem. Phys. 63: No. 5, 2109-2114 (1 Sept 1975).

Within the framework of quantum coupled-channel calculations on nonreactive atom–diatom collision systems involving two electronic potential surfaces, we test the electronically adiabatic representation obtained within the diatomics-in-molecules approximation against a similarly derived diabatic representation. The testing is numerical, with a view toward establishing computational advantages of one representation over the other with regard to (a) convergence of computed probability as the diatomic molecular basis is expanded; (b) convergence with respect to the starting position of the numerical integration; (c) convergence with respect to the distance between stabilizations; and (d) convergence with respect to the integration steplength. The adiabatic representation shows definite advantages in tests (a) and (b), but they are not sufficient to offset the much more rapid execution time possible with the diabatic basis. The significance of these results is discussed. (auth)

1871 APPROXIMATIONS FOR THE EXCHANGE POTENTIAL IN ELECTRON SCATTERING. Riley, M.E. (Sandia Laboratories, Albuquerque, New Mexico 87115); Truhlar, D.G. J. Chem. Phys. 63: No. 5, 2182-2191 (1 Sept 1975).

Four new exchange potentials (the semiclassical exchange approximation, the asymptotically adjusted free-electron–gas exchange approximation, the second-order free-electron–gas exchange approximation, and the high-energy exchange approximation) are derived. Calculations are performed for elastic electron scattering from helium and argon. The results are compared to one another and to calculations using Hara's free-electron–gas approximation and the exact nonlocal exchange potential. Three of the approximations to exchange are in good agreement with the exact exchange —except at very low energy— but are much easier to use. Thus they should be very useful in electron–atom and electron–molecule scattering calculations. (auth)

1872 INTERMOLECULAR FORCES IN GASEOUS MIXTURES: He–Ar. Smith, K.M.; Rulis, A.M.; Scoles, G. (Guelph-Waterloo Centre for Graduate Work in Chemistry, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1); Aziz, R.A.; Duquette, G. J. Chem. Phys. 63: No. 5, 2250-2252 (1 Sept 1975).

Molecular beam differential scattering measurements on the He–Ar system are reported. The results are used to study the unlike interaction (ϕ_{12}) in gaseous mixtures. (AIP)

1873 RELATIONSHIP OF THE RELATIVISTIC COMPTON CROSS SECTION TO THE MOMENTUM DISTRIBUTION OF BOUND ELECTRON STATES. Ribberfors, R. (Department of Physics and Measurement Technology, Linköping University, S-581 83 Linköping, Sweden). Phys. Rev. B 12: No. 6, 2067-2074 (15 Sept 1975).

An approximate relativistic treatment of the differential cross section for Compton scattering against bound electron states is discussed. A simple relationship between the cross section and the Compton profile is found. On contrast to previous work this relationship is valid for all scattering angles. (auth)

1874 COLLISIONAL ANGULAR MOMENTUM MIXING IN RYDBERG STATES OF SODIUM. Gallagher, T.F.; Edelstein, S.A.; Hill, R.M. (Stanford Research Institute, Menlo Park, California 94025). Phys. Rev. Lett. 35: No. 10, 644-647 (8 Sept 1975).

Collisions with rare-gas atoms are observed to produce a lengthening of the lifetime of the highly excited ($n=5$–10) d states of Na. The effect is interpreted as collisional angular momentum mixing of the d state with $l>2$ states; thus the average lifetime of all states for which $l\geq 2$ is observed. The cross section for the process appears to increase as the geometrical cross section of the excited atom. (auth)

1875 TWO-ELECTRON–ONE-PHOTON TRANSITIONS IN HEAVY-ION COLLISIONS. Wölfli, W.; Stoller, C.; Bonani, G.; Suter, M.; Stöckli, M. (Laboratorium für Kernphysik, Eidgenössische Technische Hochschule Zurich, 8049 Zürich, Switzerland). Phys. Rev. Lett. 35: No. 10, 656-659 (8 Sept 1975).

Heavy-ion–atom collisions at medium energies (~0.8 MeV/amu) yield a considerable probability for multiple inner-shell ionization. In the Ni-Ni, Ni-Fe, Fe-Ni, and Fe-Fe cases, distinct lines in the x-ray spectra are observed, which must be interpreted as a correlated two-electron jump into the doubly ionized K shell followed by the emission of only one photon carrying away the total transition energy. (auth)

1876 SURVEY OF THE INVESTIGATIONS INTO INNER-SHELL IONIZATION BY ELECTRON AND POSITRON IMPACT. El-Nasr, S. S. ATOMKI (At. Kut. Intez.) Kozl.; 17: No. 1, 71-96(1975).

A survey is given of studies, theoretical and experimental, of K shell and L shell ionization by electron and positron impact. The experimental results are compared with present theory for electron impact ionization, and experimental results for electron impact are compared with data for positron impact. (47 refs, 4 figs) (GHT)

1877 COLLISIONAL TRANSITION PROBABILITIES FOR ATOMIC HYDROGEN IN THERMAL PLASMAS FROM 1000°K TO 8000°K. Kunc, J.; Zgorzelski, M. (Warsaw Technical Univ.). At. Data Nucl. Data Tables; 15: No. 6, 543-545(Jun 1975).

Results are presented of calculations of the transition probabilities induced by electron–hydrogen atom collisions described with the aid of the classical binary encounter theory. The electrons are assumed to be Maxwellian. The range of temperatures covered is from 1000°K to 8000°K. (auth)

1878 ELASTIC SCATTERING OF POSITRONS BY HELIUM, NEON, AND ARGON. Jaduszliwer, B. Toronto; Univ. of Toronto (1973). National Library of Canada, Ottawa.

Thesis (Ph. D.).

The total cross sections for elastic scattering of positrons by helium, neon and argon have been measured below the positronium formation threshold by the method of transmission. Positrons emitted by a 14 mCi Na^{22} source are slowed down by a 0.00015" nickel foil. A small fraction (between 6×10^{-7} and 10^{-6}) of the available number of positrons emerge into the vacuum with kinetic energies of about 1 eV. These are focussed and accelerated up to any desired energy by a slow positron gun. A 90° electrostatic spherical spectrometer performs energy selection. The scattering chamber is a long cylinder, and an axial magnetic field forces the positrons to travel along helical trajectories. Positrons reach the annihilation target after travelling the length of the flight tube, and are counted with a 5% efficiency by two large opposite NaI(Tl) scintillators, operating in coincidence to detect the annihilation gamma-rays. To avoid build-up of contaminants, the experiment is performed on a flowing gas target; the purity of the gas is known to have been better than 99.99% in all cases. By alternately recording the coincidence counts with

and without gas in the tube, we obtain values of the transmitted fraction I/I_0 at different energies and different values of the axial magnetic field. This data is compared with Monte Carlo predictions of I/I_0. In our Monte Carlo calculation, the computer is fed with the positron energy, gas pressure, magnetic field and a set of assumed phase shifts for $l = 0$ to $l = 4$. Due to the presence of the axial magnetic field, the transmission I/I_0 is not only dependent on the total cross section, but also on the angular distribution of scattered positrons. Thus, by comparing experiment and Monte Carlo prediction, information about the individual values of the phase shifts can be extracted. (auth)

1879 APPLICABILITY OF THE APPROXIMATED THOMAS–FERMI POTENTIALS IN THE LOW AND INTERMEDIATE ENERGY REGIONS. Bhattacharya, R. S. (Saha Inst. of Nuclear Physics, Calcutta). Indian J. Phys.; 48: No. 10, 925-931(Oct 1974).

Thomas–Fermi-type ion–atom potentials, approximated by Lindhard for low and intermediate energy regions, were used in evaluating computationally the binary collision scattering angle for argon ions with gold and silver atoms by solving the classical equations of motion. By assuming a logarithmic relation between the impact parameter for $\pi/2$ scattering and incident ion energy, the applicability of the forms of potential for a particular range of energy is discussed in the light of the available experimental results. (4 figures) (auth)

Atomic Theory

Refer also to abstract 417.

1880 (AD/A-004220) IMPROVED CALCULATIONS OF X-RAY COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS. Semiannual Progress Report, March–September 1974. Mendelsohn, L. B. (Polytechnic Inst. of Brooklyn, N. Y. (USA). Dept. of Physics). Sep 1974. Contract N00014-67-A-0438-0011. 17p. NTIS $3.25.

See also report dated Sep 1972, AD-750768.

Progress has been made in many areas of last year's proposal. Relativistic Hartree–Fock "Impulse" Compton profiles have now been calculated for all atoms up to number 102. The Exact Hydrogenic L-shell method has been shown to give very accurate results, as compared with experiment, in the region of the profile center for scattering from neon and aluminum. Choices of atomic screening factors Z*(O), which are different from the widely used Slater's screening factors, have been shown for the 1s, 2p and 3d orbitals to give the most accurate one-electron expectation value results of all the hydrogenic screening factors considered. The Excited State Compton Profile Method has been debugged and the partial wave analysis has been shown to give agreement with a known result, for scattering from the 2s and 2p of neon, to about three significant figures. Finally, a direct variational expectation value principle has been employed to determine the Compton profile of a model system. (GRA)

1881 UUIP-820) AUTOIONIZATION IN ELECTRON SPECTROSCOPY. Bergmark, T. (Uppsala Univ. (Sweden). Fysiska Institutionen). Feb 1974. 24p. Dep. NTIS (US Sales Only) $4.25.

A survey is given of autoionization phenomena with particular consideration to applications in electron spectroscopy. The basic configuration interaction theory is described and the deexcitation process is discussed. Methods for observation of autoionization electron spectra are presented and discussed in connection with presented examples. Finally a brief account is given of calculations of the properties of autoionizing states. (14 figs., 28 refs) (auth)

1882 RADIATIVE AND RADIATIONLESS TRANSITIONS INTO UNSTABLE STATE. Svishchenko, V. V. (Tomskij Gosudarstvennyj Univ. (USSR). Sibirskij Fiziko-Tekhnicheskij Inst.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 10, 70-75(Oct 1974). (In Russian).

For English translation see the journal Sov. Phys. J.

An expression is obtained by means of which it is possible to consider radiative and nonradiative transitions in complex molecular systems, where the final state is unstable. Expressions are presented for the matrix elements $\langle E/v'_d\rangle$ and $\langle E/(d/dR_\alpha)|v'_\alpha\rangle$, where the stable state is described by a solution having a Morse potential, and the unstable state is described by a solution having a Hulthen potential. The possibility of concretely realizing these transitions with isomers as an example is discussed. (tr-SJR).

1883 COMMENT ON "INTENSITY-DEPENDENT IONIZATION POTENTIALS FOR H AND He IN INTENSE LASER BEAMS". Vermani, S.K. (Department of Physics, Southern Illinois University at Carbondale, Carbondale, Illinois 62901); Beers, B.L. Phys. Rev. A 12: No. 2, 715-718 (Aug 1975).

It is argued that a straightforward physical interpretation of the intensity-dependent ionization potentials computed by Choi, Henneberger, and Sanders is not possible. (auth)

1884 REPLY TO THE COMMENT OF VERMANI AND BEERS. Choi, C.K.; Henneberger, W.C.; Mian, S.N.; Sanders, F.C. (Department of Physics, Southern Illinois University, Carbondale, Illinois 62901). Phys. Rev. A 12: No. 2, 719-720 (Aug 1975).

The argument of Vermani and Beers is centered around two examples. The smallness of the discrepancy noted in the case of the harmonic oscillation reinforces our confidence in the validity of the Kramers transformation method for the potential case. The generalization of the method to the two-level system is fundamentally different from the potential case. We are thus unwilling to accept conclusions drawn from this particular model as having general validity. (auth)

1885 HOENL–LONDON FACTORS FOR $^3\Pi-^3\Sigma$ AND $^3\Sigma-^3\Pi$ TRANSITIONS WITH INTERMEDIATE COUPLING. Schadee, A. (Astronomical Inst., Utrecht). Astron. Astrophys.; 41: No. 2, 213-215(Jun 1975).

Hoenl-London factors of rotational lines for $^3\Pi-^3\Sigma$ and $^3\Sigma-^3\Pi$ transitions of diatomic molecules are calculated, allowing for non-zero values of both the splitting constant λ of the Σ state and the coupling constant Y of the Π state. (auth)

1886 THEORY OF FIRST ROTATIONAL LINES IN TRANSITIONS OF DIATOMIC MOLECULES. Schadee, A. (Astronomical Inst., Utrecht). Astron. Astrophys.; 41: No. 2, 203-212(Jun 1975).

Correct expressions for the energies of the first rotational levels (those with $J < \Lambda + S$) and the Hoenl-London factors for transitions involving these levels are derived for doublet and triplet states and transitions in diatomic molecular spectra. (auth)

1887 PROBLEM OF CALCULATING MOLECULAR CONSTANTS FROM OSCILLATION SPECTROSCOPIC DATA. Schmidt, K. Dortmund, Ger.; Univ. Dortmund (1973). 173p. (In German). INIS.

Thesis.

Approximation methods for the calculation of molecular force constants are given. (GE)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

1888 HYDROMAGNETIC FLOW BETWEEN TWO PARALLEL PLANES, ONE OSCILLATING AND THE OTHER FIXED. Gupta, P. R.; Arora, K. L. (Panjab Engineering Coll., Chandigarh (India). Dept. of Applied Sciences). Pure Appl. Geophys.; 112: No. 2, 498-505(1974).

Exact solution of the hydromagnetic flow between two parallel, nonconducting, infinite planes, one oscillating and the other fixed, has been obtained. The effect of an applied transverse magnetic field on various flow characteristics is studied in detail for a small magnetic Prandtl number ($Pr_m \ll 1$). The viscous drag acting on the two planes has been determined. (auth)

1889 QUANTUM WAVE SPECTRUM IN ELECTROFLUID OF METAL. Okulov, V. I.; Pamyatnykh, E. A. (AN SSSR, Sverdlovsk. Inst. Fiziki Metallov; Ural'skij Gosudarstvennyj Univ., Sverdlovsk (USSR)). Fiz. Metal. Metalloved.; 38: No. 2, 279-288(Aug 1974). (In Russian).

For English translation see the journal Phys. Met. Metallogr.

A dispersion equation is obtained for quantum waves, propagating in an electronic liquid along a magnetic field, without a limitation in the number of Fermi-liquid constants. It is shown that because of the existence of spin oscillations a splitting of the frequencies of both the longitudinal and transverse quantum waves occurs. The Fermi-liquid interaction also leads to the appearance of particular oscillations not associated with the electromagnetic field. (auth)

1890 NMR RELAXATION TIME IN SUPERFLUID ^{3}He. Combescot, R. (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York 14853). Phys. Rev. Lett. 35: No. 7, 471-473 (18 Aug 1975).

The temperature dependence of the NMR relaxation time introduced by Combescot and Ebisawa, τ_{CE}^{*}, is studied from the microscopic theory. It diverges like $(1-T/T_c)^{-1/2}$ near T_c, in agreement with Leggett and Takagi's prediction. At low temperature, it grows like $1/T^3$ in the A phase (except at extremely low temperature where it grows like $1/T^5$) and like $T^{-1/2}e^{\Delta/T}$ in the B phase. (auth)

1891 SPIN RELAXATION IN SUPERFLUID ^{3}He. Bhattacharyya, P. (Department of Physics and Materials Research Laboratory, University of Illinois, Urbana, Illinois 61801); Pethick, C.J.; Smith, H. Phys. Rev. Lett. 35: No. 7, 473-476 (18 Aug 1975).

We show that near the transition temperature T_c the relaxation time introduced in Leggett and Takagi's phenomenological theory of spin relaxation in superfluid ^{3}He is equal to the relaxation time of a normal-state quasiparticle at the Fermi energy at T_c, and is independent of the superfluid state. Combescot and Ebisawa's relaxation time is found to diverge as $(T_c-T)^{-1/2}$. These results are obtained by deriving and solving exactly the Boltzmann equation for quasiparticles in the superfluid. (auth)

1892 EDDY VISCOSITY OF TURBULENT SUPERFLUID ^{4}He. Childers, R.K.; Tough, J.T. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). Phys. Rev. Lett. 35: No. 8, 527-529 (25 Aug 1975).

Measurements of the pressure gradient accompanying thermal counterflow in helium II have been made for both glass and metal flow tubes. A pressure in addition to that from the laminar Poiseuille flow of the normal fluid is observed when mutual friction is observed to be present. This excess pressure is described in terms of an eddy viscosity due to the interactions between the vortex lines. The eddy viscosity is found to depend only on the density of vortex lines present. (auth)

1893 VARIATIONAL CALCULATIONS OF LIQUID ^{4}He WITH FREE SURFACES. Liu, K.S.; Kalos, M.H. (Courant Institute of Mathematical Sciences, New York University, New York, New York 10012); Chester, G.V. Phys. Rev. B 12: No. 5, 1715-1719 (1 Sept 1975).

Results of variational calculations of the surface profile and energy of the free surface of liquid helium are presented. The trial wave function is taken to be a product of two-body Jastrow factors and one-body factors. We performed the numerical computations using Monte Carlo techniques. The obtained suface energy is 0.21 °K/Å^2 compared with the experimental value of 0.27 °K/Å^2. The density profile is found to have a very weak layered structure near the free surface. A scheme is proposed and carried out to test the consistency of other approximate microscopic calculations of the surface profile and energy. We also suggest that experiments be considered to probe the surface structure. (auth)

1894 MEASUREMENT OF ANOMALOUS DISPERSION AND THE EXCITATION SPECTRUM OF He II. Dynes, R.C.; Narayanamurti, V. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. B 12: No. 5, 1720-1730 (1 Sept 1975).

A detailed account of the propagation of superthermal phonons ($\hbar\omega > kT$) in He II is presented as a function of pressure up to the solidification point and at low temperatures. Superconducting Al fluorescers and tunnel junctions are used for this study. The measurements show that a well-defined cutoff energy E_c exists, below which the spontaneous decay of a high-frequency phonon via the three-phonon process occurs in He. From measurements of E_c and the group velocity v_g at E_c, we obtain numerical estimates for the magnitude of the anomalous dispersion as a function of pressure. The results show that simple polynomial expansions do not quantitatively describe all the available data and that current models involving two branches in the excitation spectrum describe the situation somewhat better. (auth)

1895 TRAPPING OF PERSISTENT CURRENTS IN SUPERLEAKS. Heiserman, J.; Rudnick, I. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. B 12: No. 5, 1739-1741 (1 Sept 1975).

In a toroidal persistent-current apparatus which is partially packed with superleak, high-velocity persistent currents are found in the superleak and only barely perceptible currents, at most, are found outside the superleak. (auth)

1896 RELATIONSHIP BETWEEN THE LINEAR RINGING FREQUENCIES IN ^{3}He-A AND ^{3}He-B NEAR THE POLYCRITICAL POINT. Webb, R.A.; Sager, R.E.; Wheatley, J.C. (Department of Physics, University of California at San Diego, La Jolla, California 92037). Phys. Rev. Lett. 35: No. 9, 615-617 (1 Sept 1975).

New measurements of parallel ringing in a quasi-ideal geometry for ^{3}He-B near the temperature and pressure of the polycritical point suggest $f_B^2/f_A^2 \sim 5/2$, where f_B and f_A are the linear parallel-ringing frequencies at a given temperature near T_c. This result approaches the prediction of theory using the Anderson-Brinkman-Morel and Balian-Werthamer states to describe ^{3}He-A and ^{3}He-B, respectively, and hence the results of Osheroff at melting pressure, but disagrees with earlier observations at pressures near the polycritical point. (auth)

1897 THEORY OF ENVELOPE SHOCK. Mima, K.; Nishikawa, K. (Faculty of Science, Hiroshima University, Hiroshima, Japan); Ikezi, H. Phys. Rev. Lett. 35: No. 11, 726-728 (15 Sept 1975).

We find a solution of the nonlinear Schrödinger equation which describes a standing electron plasma wave confined in the half-space underdense region with reflected electrons in the other half space. The shock moves with the ion-acoustic speed and the density jump is proportional to the electron-wave amplitude. (auth)

1898 MEASUREMENT OF EQUILIBRIUM CRITICAL VELOCITIES FOR VORTEX FORMATION IN SUPERFLUID HELIUM. DeConde, K.; Packard, R.E. (Physics Department, University of California, Berkeley, California 94720). Phys. Rev. Lett. 35: No. 11, 732-734 (15 Sept 1975).

We have made measurements of the critical velocity for vortex formation in right cylinders of circular, elliptical, and rectangular cross section. The procedure used seems to produce the superfluid in its equilibrium state and the results are in good quantitative agreement with theoretical calculations based on equilibrium thermodynamics. (auth)

1899 STABILITY OF A DIFFERENCE DIAGRAM FOR ONE PROBLEM OF MAGNETOHYDRODYNAMICS. Koronev, N. K. Vestn. Leningrad. Univ., Fiz., Khim.; 19: No. 4, 33-41(Oct 1974). (In Russian).

This paper is concerned with the unique solvability of several problems in different functional spaces. The purpose here is to construct a stable difference diagram for one of these problems. It is proven that the solutions to the finite-difference diagrams studied here converge rapidly to the precise solution in the numerical analog of the L_p-norm for any p less than 4. It is suggested that the fluid and the field will fill a square domain. (JPRS)

1900 INSTABILITY OF VORTEX LINES IN THE PRESENCE OF AXIAL NORMAL FLUID FLOW. Ostermeier, R. M.; Glaberson, W. I. (Rutgers-The State Univ., New Brunswick, NJ). J. Low Temp. Phys.; 21: No. 1/2, 191-196(Oct 1975).

It is shown that a normal mode analysis of the complete Hall two-fluid equations in rotating He II yields a critical velocity for axial normal fluid flow which is identical to the critical velocity derived in an earlier paper from the superfluid equation alone. A simplified derivation of the critical velocity based on consideration of the forces acting on an isolated vortex line is also presented. The analysis is extended to ^{3}He-^{4}He solutions and it is shown that rather small impurity concentrations can greatly increase the critical heat current in axial thermal counterflow. (1 figure) (auth)

1901 APPROXIMATE SOLUTION OF MAGNETOHYDRODYNAMIC TWO-DIMENSIONAL STAGNATION POINT FLOW.

Dutta, N.; Jana, R. N. (Indian Inst. of Tech., Kharagpur). Indian J. Phys.; 48: No. 10, 865-871(Oct 1974).

The Kármán–Pohlhausen integral method was used to study the steady, two-dimensional stagnation point flow of an electrically conducting viscous incompressible fluid with an applied magnetic field. It was found that the nondimensional viscous and the magnetic boundary layer thicknesses and the magnitude of the skin friction increase with an increase of magnetic field. (auth)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

Refer also to abstracts 1425, 1426, 2061, 2063, and 2547.

1902 (DL/R-35) HIGH ENERGY PHYSICS. 1974 Progress Report. (Science Research Council, Daresbury (UK). Daresbury Lab.). 1975. 50p. Dep. NTIS (US Sales Only) $5.50.

On the NINA electron synchrotron the year has seen the completion of data collection on electroproduction by the Daresbury/Frascati/Pisa Collaboration and the continuation of the work of the Glasgow/Liverpool/Sheffield Collaboration on pion production using a polarized beam and a polarized target. Two new sets of experimental apparatus have continued their construction phase during the year; these are the Daresbury/Lancaster/Sheffield apparatus for the study of multiparticle final states and the electroproduction equipment of the Daresbury/Lancaster/Manchester Collaboration. Both of these experiments are expected to begin their data collection during 1975. A more detailed description is also given of the development of particular experiments. For convenience, divisions into NINA; CERN proton synchrotron (PS); CERN Intersecting Storage Rings (ISR) and CERN SPS are made. A complete list of all the proposals submitted to the Selection Panel with the status of each one is given. The current layout of the NINA experimental area is shown. A report is given of the instrumentation work which was carried out within the group and in which colleagues from other groups and divisions of the laboratory were intimately involved. An account is given of the work of the theory group. A list of publications is included. (auth)

1903 DEVICE FOR THE GENERATION OF MONOCHROMATIC GAMMA RADIATION OF VARIABLE ENERGY UP TO 120 MeV BY POSITRON ANNIHILATION IN FLIGHT. Hauptmann, A. Mainz; Mainz Univ. (1973). 40p. (In German). INIS.

Thesis.

A device is described which generates nearly monoenergetic gamma quanta of variable energy by two-gamma annihilation of monoenergetic positrons. The energy distribution of positrons and electrons emitted from a conversion target within small foreward solid angle is measured for different primary electron energies. (auth)

Electromagnetic

Refer also to abstract 1949.

1904 (JINR-P10-8945) SIMULATING, ANALYSIS, AND PROCESSING OF EXPERIMENTAL DATA ON INVERSE PION ELECTROPRODUCTION. Part 1. Berezhnev, S. F.; Smirnov, G. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1975. 15p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A system of programs is designed for simulating, analysis, and processing of experimental data in studying the process $\pi^- p \rightarrow e^+e^-n$. The model of the process event used in the programs was described as well as the program SIMUL 1, that simulates the reaction and takes into account the real experimental conditions. (4 figures) (auth)

1905 SEARCH FOR MULTI-PHOTON EVENTS FROM pp INTERACTIONS AT 300 GeV/c. Stevens, D. M. Blacksburg, VA; Virginia Polytechnic Inst. (1975). 63p. University Microfilms Order No. 75-11,949.

Thesis (Ph. D.).

Using a detector developed in a VPI-BNL collaboration a search was made for multi-photon events from pp interactions at 300 GeV/c. The multiplicity, energy and angular distributions of approximately 340,000 events was measured. Of the 80,000 events that were analyzed, the angular distributions are consistent with photon production by known processes. The energy distribution of photons shows a rise in cross sections at approximately 150 GeV, an anomaly which can not be explained by known processes. (Diss. Abstr. Int., B)

1906 PHOTOPRODUCTION OF THE ψ PARTICLES. Camerini, U.; Learned, J.G.; Prepost, R.; Spencer, C.M.; Wiser, D.E. (University of Wisconsin, Madison, Wisconsin 53706); Ash, W.W.; Anderson, R.L.; Ritson, D.M.; Sherden, D.J.; Sinclair, C.K. Phys. Rev. Lett. 35: No. 8, 483-486 (25 Aug 1975).

The *s* and *t* dependence of incoherent ψ (3100) photoproduction from deuterium has been measured at the Stanford Linear Accelerator Center. ψ (3700) photoproduction and ψ (3100) photoproduction from hydrogen have also been measured. (auth)

1907 HIGH-MOMENTUM HADRONS FROM e^+e^- REACTIONS: SPECTRA, PARTICLE RATIOS, AND MULTIPLICITIES. Atwood, T.L.; Barnett, B.A.; Trasatti, L.V.; Zorn, G.T. (University of Maryland, College Park, Maryland 20742); Cavalli-Sforza, M.; Goggi, G.; Mantovani, G.C.; Piazzoli, A.; Rossini, B.; Scannicchio, D.; Coyne, D.G.; O'Neill, G.K.; Sadrozinski, H.F.W. Phys. Rev. Lett. 35: No. 11, 704-707 (15 Sept 1975).

We present results from a study of high-momentum inclusive hadron production in electron-positron interactions at $\sqrt{s}=3.8$ and 4.8 GeV. Comparison of the momentum spectra at these energies shows no scaling violation in the region $x\ (=E/E_{beam}) > 0.7$. At $\sqrt{s}=4.8$ GeV the K/π ratio for hadrons with momenta > 1.1 GeV/*c* is 0.27 ± 0.08, and the average number of charged hadrons is 3.6 ± 0.3 for those events which have at least one charged hadron with momentum greater than 1.1 GeV/*c*. (auth)

1908 PHASE OF A MICROSCOPIC ELECTROMAGNETIC FIELD AND ITS MEASUREMENT. Paul, H. (Zentralinstitut fuer Optik und Spektroskopie, Berlin). Fortschr. Phys.; 22: No. 11, 657-659(1974).

A novel approach to the quantum mechanical description of phase properties of a one-mode low intensity radiation field is presented. The procedure is based upon the correspondence between Glauber states and classical waves of fixed phase φ and amplitude α, and, in contrast to the conventional quantum mechanical phase concepts, allows one to make contact between certain operators E_m corresponding to the classical quantities $\exp\{im\varphi\}$ ($m = \pm1, \pm2, \ldots$) and realistic measurements. In the observation, a large amplification of the microscopic field by means of a linear quantum amplifier plays a decisive role. Since the amplified field is a macroscopic one, the measurement of phase is not problematic, and hence, in particular, average values $\langle\langle \exp\{im\varphi\}\rangle\rangle$ can be determined experimentally. The main result of the analysis is that the mean values $\langle\langle \exp\{im\varphi\}\rangle\rangle$ are equal to the quantum mechanical expectation values for the operators E_m with respect to the field before amplification. To obtain this result it became necessary to calculate Glauber's P function for the amplified field in case of an arbitrary state for the initial field. (auth)

1909 F MESON CONTRIBUTION TO CHARGE ASYMMETRY OF π MESONS IN THE REACTION $e^+e^- \rightarrow \pi^+\pi^-$. Novikov, V. N.; Eidel'man, S. I. (Inst. of Nuclear Physics, Moscow). Yadern. Fiz.; 21: No. 5, 1029-1032(May 1975). (In Russian)

The $2\pi^+2\pi^-$ decay of the f meson is treated under the assumption that it proceeds via an intermediate $\rho^0\rho^0$ state. The found $f-\rho$ coupling constant is used to estimate the charge asymmetry of π mesons in the reaction $e^+e^- \rightarrow \pi^+\pi^-$. When the total energy 2E = 1.3 GeV the asymmetry reaches 8.1%. (2 figures) (auth)

1910 PROTON RECOIL POLARIZATION MEASUREMENT AT NEUTRAL PION PHOTOPRODUCTION. Minatti, N. D. Bonn; Bonn Univ. (1973). 66p. (In German). INIS.

Thesis.

The proton recoil polarization of the $\gamma + p \rightarrow \pi^0 + p$ reaction is measured at 20 points in the 360 to 1,000 MeV γ-energy range and at 60, 90, 105, 120, 135, and 150 deg. pion c.m.-angle distribution using ^{12}C analysator. (auth)

Weak

1911 SEARCH FOR MONOENERGETIC γ RAYS FROM Ψ (3684) DECAY. Simpson, J.W.; Beron, B.L.; Ford, R.L.; Hilger, E.; Hofstadter, R.; Howell, R.L.; Hughes, E.B.; Liberman, A.D.; Martin, T.W.; O'Neill, L.H. (High Energy Physics Laboratory and Department of Physics, Stanford University, Stanford, California 94305); Resvanis, L.K. Phys. Rev. Lett. 35: No. 11, 699-701 (15 Sept 1975).

Results are reported of a search for monoenergetic γ rays with energies above 50 MeV from ψ (3684) decay using large NaI(Tl) spectrometers. No clear evidence for emission of such radiation was found. (auth)

1912 RARE DECAYS OF THE K^0/sub L/. Donaldson, G. J. Stanford, CA; Stanford Univ. (1975). 111p. University Microfilms Order No. 75-13,515.

Thesis (Ph. D.).

Using the SLAC K^0/sub L/ Spectrometer Facility, the ratio Gamma(K^0/sub L/ yields $\pi^+\pi^-$ gamma)/Gamma(K^0/sub L/ yields all) was measured to be $(6.2 \pm 2.1) \times 10^{-5}$. The rate and Dalitz plot distribution of 24 ± 10 events are consistent with CP conservation in this weak-electromagnetic decay. Also upper limits were set on the processes K^0/sub L/ yields $\mu^+\mu^-$ gamma, $\mu^-\pi^0$, $\pi^+\pi^-e^+e^-$, and $\pi^0\pi^+e^-$ nu. (Diss. Abstr. Int., B)

1913 EXPERIMENTAL DETERMINATION OF THE LIMIT ON THE CROSS SECTION OF REACTOR ANTINEUTRINO SCATTERING BY A PROTON. Bazhutov, Yu. N. Yadern. Fiz.; 21: No. 5, 1052-1054(May 1975). (In Russian)

An experimental limit on the elastic ($\bar{\nu}_e$p) scattering cross section is obtained for reactor antineutrino: $\sigma \lesssim 7.6 \cdot 10^{-37}$ cm^2. The obtained results make it impossible to solve the sun neutrino problem in the framework of the above mentioned interaction. (1 table) (auth)

Strong (Baryon-induced)

1914 (BNL-20503) SEARCH FOR STRUCTURE IN THE GAMMA-RAY SPECTRA FROM ANTI PD AND ANTI PP ANNIHILATIONS AT REST. Lowenstein, D. I.; Nathan, A. M.; Samios, N. P.; Schwarzschild, A. Z.; Kalogeropoulos, T. E.; Michael, D. N. (Brookhaven National Lab., Upton, N. Y. (USA); Syracuse Univ., N.Y. (USA). Dept. of Physics). 1975. 7p. (CONF-750842-1). Dep. NTIS $4.00.

From 6th topical conference in particle physics; Honolulu, Hawaii, USA (6 Aug 1975).

The results of an experiment to observe discrete energy gamma rays from anti pp annihilations at rest using a 750-MeV/c separated antiproton beam are discussed. The gamma spectra for all four energy leakage levels, summed over all charged particle multiplicities are shown for hydrogen and deuterium, respectively. It is concluded that to 1 percent of the continuum for discrete gamma lines between 50 and 200 MeV and with a 15 percent energy resolution one observes no structure in the gamma spectra of antiproton annihilations in hydrogen or deuterium. (JFP)

1915 (CONF-750654-13) STUDY OF THE REACTIONS dp → dp$\pi^+\pi^-$ AND dp−dnπ^+ AT 3.3 GeV/c IN THE HYDROGEN BUBBLE CHAMBER. Aladashvili, B. S.; Badelek, B.; Glagolev, V. V.; Gorbunov, A. N.; Khairetdinov, K. U.; Lebedev, R. M.; Nioradze, M. S.; Odyniec, G.; Saitov, I. S.; Streltsov, V. N.; Sandacz, A.; Siemiarczuk, T.; Stepaniak, J.; Zielinski, P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. Dep. NTIS (US Sales Only) $4.00.

From high energy particle physics divisional conference of EPS; Palermo, Italy (23 Jun 1975).

A narrow enhancement in the (dπ^+) effective mass spectrum is observed for the dp → dp$\pi^+\pi^-$ and dp → dnπ^+ reactions at an incident deuteron momentum of 3.3 GeV/c. The position and width of the enhancement are (2.151 ± 0.005) GeV and (13 ± 6) MeV, respectively. The signal in the (dπ^+) mass distribution at (2.294 ± 0.005) GeV with a width of 47 ± 13 MeV is also observed in the dp → dnπ^+ reaction, and it is identified as a kinematic effect. (auth)

1916 (JINR−P1-8938) ASYMMETRY IN THE ELASTIC PD SCATTERING AT THE PROTON ENERGY OF 630 MeV. Murtazaev, Kh.; Nadezhdin, V. S.; Satarov, V. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 8p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The angular dependence of the asymmetry parameter in the elastic pd scattering in the polarized proton beam at 630 MeV was measured. The data on the particle escape asymmetry in the reactions pd → pd and pp → πd at large momentum transfer do not contradict the predictions of the resonance model of the one-pion exchange. (auth)

1917 SIGMA MINUS: PROTON ELASTIC SCATTERING AT 23 GeV/c. Majka, R. D. New Haven; Yale Univ. (1974). 131p. University Microfilms Order No. 75-15,333.

Thesis (Ph. D.).

The differential cross section, d sigma/dt, for the elastic scattering of 23 GeV/c SIGMA$^-$ from hydrogen in the t range -0.10 to -0.23 (GeV/c)^2 were measured. The momentum of the SIGMA$^-$ and its charged decay product was measured by magnetic spectrometers with magnetostrictive wire chambers. The scattering angle of scattered SIGMA$^-$ was measured by two sets of high pressure, high resolution spark chambers. Events were constrained to be elastic by measuring dE/dx and the kinetic energy of the recoil proton in a set of scintillation counters surrounding the hydrogen target. A threshold Cerenkov counter in the beam channel tagged pi$^-$ in the beam. A sample of pi$^-$-p elastic events were collected at the same time as the SIGMA$^-$-p events. The cross sections for pi$^-$-p and SIGMA$^-$-p elastic scattering were fitted with an exponential: d rho/dt equals A(t) e/sup a + bt/ where A(t) is an acceptance correction determined by a Monte Carlo calculation. The values for the slope (b) obtained from the fit are: b/sub pi$^-$/ equals 7.89 +- .24 (GeV/c)$^{-2}$ and b/sub SIGMA$^-$/ equals 8.99 +- .39 (GeV/c)$^{-2}$. (Diss. Abstr. Int., B)

1918 BACKWARD PRODUCTION IN pi$^-$p YIELDS p pi$^+$pi$^-$pi$^-$ AT 8.0 GeV/c IN A STREAMER CHAMBER. Morris, G. R. Urbana, IL; Univ. of Illinois (1975). 200p. University Microfilms Order No. 75-14,147.

Thesis (Ph. D.).

A data sample is investigated consisting of 1227 events of the form pi$^-$p yields p pi$^+$pi$^-$pi$^-$ where the final state proton is produced fast and forward in the laboratory system. The data sample was obtained using an 8.0 GeV/c pion beam and the University of Illinois-ANL streamer chamber. The dominant feature displayed in the data sample is the quasi-two body production of rho N* and fN* intermediate states. No evidence is found for backward A_1 or A_2 production, but a three standard deviation enhancement in the pi$^+$pi$^-$pi$^-$ mass distribution is observed near 1900 MeV/c^2. Cross section upper limits are obtained for backward A_1 and A_2 production. The rho N* and fN* intermediate states are investigated with regard to the peripheralism of the production mechanism and sequential decay of the meson and baryon systems. These processes appear to be consistent with the hypothesis of u-channel proton exchange as the dominant production mechanism. The possibility of enhancements in the p pi$^-$pi$^-$ and p pi$^+$pi$^-$ final states is investigated. (Diss. Abstr. Int., B)

1919 LOW MOMENTUM TRANSFER PROTON–PROTON ELASTIC SCATTERING UP TO 400 GeV. Gross, D. A. Rochester, NY; Univ. of Rochester (1974). 214p. University Microfilms Order No. 75-15,203.

Thesis (Ph. D.).

A hydrogen jet target was used to study pp scattering. The target was installed in the internal beam of the N.A.L. Accelerator. Solid state detectors were used to detect the low energy recoils, close to 90^0 from the forward direction. A total of about 14 x 10^6 elastic events, equally divided between the two phases of the experiment, were obtained in the study of the low momentum transfer scattering. The forward diffraction peak (in the range .004 less than -t less than .2 (GeV/c)^2) and the real-to-imaginary ratio (in the range .001 less than -t less than .04 (GeV/c)^2) of the nuclear scattering amplitude energy dependence were derived in the range 40 to 400 GeV/c, laboratory momentum. The results indicate a continuing shrinkage of the forward peak, even if at a reduced rate from Serpukhov energies. The zero-crossing of the real-to-imaginary ratio at about 300 GeV is strong evidence for the rise in the total cross section in the N.A.L.–I.S.R. energy region. (Diss. Abstr. Int., B.)

1920 ANTIPROTON--PROTON ANNIHILATION INTO TWO CHARGED PARTICLES AND ONE OR TWO NEUTRAL KAONS AT INCIDENT LABORATORY MOMENTUM OF 300 TO 800 MeV/c. Brush, A. W. Madison, WI; Univ. of Wisconsin (1974). 118p. University Microfilms Order No. 75-5922.

Thesis (Ph. D.).

This study includes the reactions: (1) anti pp yields pi/sup +-/ K/sup -+/K^0; (2) anti pp yields pi/sup +-/K/sup -+/K/sub S/^{0}pi^0; (3) anti pp yields pi$^+$pi$^-$K/sub S/^{0}K/sub L/^{0}; (4) anti pp yields pi$^+$pi$^-$K/sub S/^{0}K/sub S/^{0}; and (5) anti pp yields pi$^+$pi$^-$K/sub S/^{0} K/sub S/^{0}pi^0 obtained from a total of about 225,000 pictures of anti pp interactions at laboratory momenta between 300 and 800 MeV/c in the Brookhaven National Laboratory 30" hydrogen bubble chamber. Cross sections for all these reactions were measured at five different momenta between 300 and 800 MeV/c. Enhancements were found between 500 and 600 MeV/c for reactions (2) and (3). It appears unlikely that these enhancements are due to resonance formation. Abundant resonance production was found, including K*(890) in reactions (1) through (4), rho in reactions (2) and (4), and omega^0 for reaction (5). Smaller amounts of other resonances were also seen. Suppression of rho in reaction (3) and of eta^0 in reaction (5) indicates that C equals -1 amplitudes may dominate these reactions. For reaction (1), an observed asymmetry in the Dalitz plot leads to a discussion of interference among isospin amplitudes. (Diss. Abstr. Int., B)

1921 SEARCH FOR MORE *J* PARTICLES. Aubert, J.J.; Becker, U.; Biggs, P.J.; Burger, J.; Chen, M.; Everhart, G.; Leong, J.; Rhoades, T.G.; Rohde, M.; Sanford, T.; Ting, S.C.C.; Toki, W.H.; Wu, S.L. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139); Glenn, J.W. III; Lee, Y.Y. Phys. Rev. Lett. 35: No. 7, 416-419 (18 Aug 1975).

We report here on an experiment done at the 30-GeV proton synchrotron at Brookhaven National Laboratory using a large-acceptance (Δm=1 GeV) pair spectrometer with a mass resolution of ±5 MeV, to search for additional long-lived particles which decay into $K^-\pi^+$, $K^+\pi^-$, $\bar{p}p$, K^+K^-, $\pi^+\pi^-$, K^-p, π^-p, $K^+\bar{p}$, or $\pi^+\bar{p}$. The result, based on 2×10^7 events, shows that, to a sensitivity comparable to or lower than the production of *J* particles [(production) × (decay branching ratio) ≃10^{-34} cm^2], no additional states were found. (auth)

1922 EVIDENCE FOR DOUBLE DIFFRACTION IN *pp* INTERACTIONS AT 300 GeV/c. Firestone, A.; Davidson, V.; Nagy,

F.; Peck, C.; Sheng, A. (California Institute of Technology, Pasadena, California 91109); Dao, F.T.; Hanft, R.; Lach, J.; Malamud, E.; Nezrick, F.; Dzierba, A.; Poster, R.; Slater, W. Phys. Rev. D 12: No. 1, 15-19 (1 July 1975).

We have observed evidence for the double diffraction process $pp \rightarrow N^*N^*$ at 300 GeV/c. The symbol N^* is used here to refer to the low-mass enhancement which decays into three charged particles (with or without neutrals). The cross section for this reaction is measured to be 0.12 ± 0.05 mb. The cross section for the single-beam-diffraction reaction, $pp \rightarrow pN^*$, is measured to be 0.82 ± 0.08 mb. These data are in good agreement with the predictions of the factorization hypothesis. (auth)

1923 EVENTS OF POSSIBLE ASSOCIATIVE PRODUCTION OF CHARMED PARTICLES IN EMULSIONS. Komar, A.A.; Orlova, G.I.; Tret'yakova, M.I.; Chernyavskiĭ, M.M. (P. N. Lebedev Physico-technical Institute, USSR Academy of Sciences). JETP Lett. 21: No. 8, 239-241 (20 Apr 1975).

We observed two stars produced in emulsion by protons with p=200 GeV/c, in which a single electron is emitted practically from the center of the star and a particle with mass ~2 GeV is produced simultaneously. The events can be interpreted as a manifestation of associative production of a charmed baryon and a charmed meson. (auth)

1924 WIDE-ANGLE DIFFERENTIAL CROSS SECTIONS FOR ELASTIC PROTON-PROTON SCATTERING IN THE REGION OF Δ (1236) PRODUCTION. Abe, K.; Barnett, B.A.; Goldman, J.H.; Laasanen, A.T.; Steinberg, P.H. (University of Maryland, College Park, Maryland 20742); Marmer, G.J.; Moffett, D.R.; Parker, E.F. Phys. Rev. D 12: No. 1, 1-5 (1 July 1975).

Differential cross sections for p-p elastic scattering are presented with scattering angles in the center-of-mass system greater than 35° to 50°. The data were obtained at incident laboratory momenta 0.857, 1.091, 1.210, 1.374, 1.405, and 1.501 GeV/c. This spans the region of the onset of Δ (1236) production and where a possible spin-singlet D-wave resonance is indicated in an analysis of earlier data. (auth)

1925 NEW RESULTS OF A PROTON-PROTON BREMSSTRAHLUNG EXPERIMENT AT 42 MeV. Greeniaus, L.G.; Jovanovich, J.V.; Kerchner, R.; Millar, T.W.; Smith, C.A.; Suen, K.F. (Cyclotron Laboratory, Department of Physics, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2). Phys. Rev. Lett. 35: No. 11, 696-698 (15 Sept 1975).

We report the results of new measurements and analysis of 42-MeV proton-proton bremsstrahlung cross sections. Comparison with the predictions of the Hamada-Johnston potential over proton polar-angle ranges from 16° to 40° is made and significant disagreement is observed. (auth)

1926 STRUCTURE OF NUCLEONS AT SMALL DISTANCES. Aubert, J.J.; Becker, U.; Biggs, P.J.; Burger, J.; Chen, M.; Everhart, G.; Leong, J.; Rhoades, T.G.; Rohde, M.; Ting, S.C.C.; Toki, W.; Wu, S.L. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139); Glenn, J.W. III; Lee, Y.Y. Phys. Rev. Lett. 35: No. 10, 639-641 (8 Sept 1975).

We report here the observation of surprisingly simple behaviors in the massive-hadron-pair (m>2 GeV) production from proton-nucleon collisions. With a 28.6-GeV incident proton beam and a pair spectrometer to detect the hadrons, the measured cross section decreases like $d^2\sigma/dxdm \propto e^{-5m}$ and can be grouped into three groups: $\pi^- + p$; $\pi^+ + \pi^-$, $\bar{p} + p$, $K^- + p$; and $K^- + \pi^+$, $\pi^+ + \bar{p}$. Within a given group the yield is the same to ±20%; different groups are separated by a factor of ~10 from each other. (auth)

1927 MEASUREMENT OF THE PROTON-NEUTRON ELASTIC-SCATTERING POLARIZATION FROM 2 TO 6 GeV/c. Diebold, R.; Ayres, D.S.; Kramer, S.L.; Pawlicki, A.J.; Wicklund, A.B. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. Lett. 35: No. 10, 632-635 (8 Sept 1975).

Left-right asymmetries from a deuterium target in a polarized-proton beam were observed with the Argonne National Laboratory effective-mass spectrometer. Results were obtained for both pp and pn elastic scattering from $-t$=0.15 to 1.0 GeV² at 2, 3, 4, and 6 GeV/c. For $-t \lesssim 0.6$ GeV² the pn polarization was found to have the same sign as for pp, but with faster energy dependence, the ratio P (pn)/P (pp) at $-t$=0.3 GeV² falling from 0.78±0.02 at 2 GeV/c to 0.22±0.03 at 6 GeV/c. (auth)

1928 PI-NUCLEON PHENOMENOLOGY AT HIGH ENERGIES. Kogitz, S. I. Toronto; Univ. of Toronto (1973). National Library of Canada, Ottawa.

Thesis (Ph. D.).

A brief introduction to the phenomenology of strong interactions at high energy is presented. This includes discussion of the topics including absorption, finite energy sum rules, and duality. The application of these ideas to two-particle inelastic reactions is examined with particular emphasis on the reaction $\pi^-p \rightarrow \pi^0 n$. This reaction is of fundamental importance because of its simplicity. A particular model is developed for the above reaction. Polarization and differential cross section data at large angles are explained in terms of a simple model including a ρ Regge pole plus a background term representing either a pole or a cut in the complex angular momentum plane. The characteristic dip-bump structure of the data arises from a zero in the ρ amplitude where its spin trajectory is zero, and the recovery is due to the background term. The same approach is employed in the backward direction to explain π^+p, π^-p and backwards π^-p charge exchange scattering. In the backward region it is a baryon rather than a meson whose amplitude passes through zero. The background is assumed to have the same structure as in the forward direction. Finally, the possibility that the background is a fixed pole is explored. While there is no commitment to a fixed pole in the model, some justification is deemed necessary since that singularity arises naturally in the phenomenology. (Diss. Abstr. Int., B)

1929 MULTIPARTICLE PRODUCTION IN THE INTERACTIONS OF CHARGED COSMIC RAY HADRONS WITH NUCLEAR TARGETS. Viswanath, P. R. Ann Arbor, MI; Univ. of Michigan (1974). 136p. University Microfilms Order No. 75-10,325.

Thesis (Ph. D.).

An experiment was conducted at the High Altitude Laboratory, New Echo Lake, Colorado, to study interactions of charged cosmic ray hadrons of energy greater than 100 GeV with nuclear targets. The experiment employed two wide gap spark chambers, an ionization calorimeter and targets of aluminium, iron, tin, and lead. Out of more than 400 interactions collected over a period of one and one-half years, about 500 interactions were selected for the final analysis. Monte Carlo models for proton-nucleus interactions were developed to correct for the systematic biasses in the data. The ratio of the average charged multiplicity in a proton-nucleus collision to the average charged multiplicity in a proton-proton collision was observed to vary slowly with the mass number of the nucleus; the dependence of this ratio on the mass number was given by a power law with an exponent of 0.129 +- 0.004. There was no significant variation of this ratio with the energy of the primary particle. The study of the angular distribution characteristics showed that the major increase in the multiplicity was due to particles at large angles. The multiplicity in the very forward direction was constant and independent of the mass number. The major conclusion of the experiment was the slow variation of the interaction characteristics with the mass number of the target nucleus. (Diss. Abstr. Int., B)

1930 PRODUCTION MECHANISM FOR THE BOSON WITH MASS 3.1 GeV. Zakharov, V. I.; Ioffe, B. L.; Okun, L. B.; Khovanskii, V. D. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 21: No. 5, 1064-1067(May 1975). (In Russian)

Based on comparison between two experiments, where the neutral 3.1-GeV boson was detected, some arguments are presented in favor of its hadronic nature. (2 figures) (auth)

1931 EXPERIMENTAL INVESTIGATIONS OF CUMULATIVE MESOPRODUCTION AT EXCITATION OF VARIOUS NUCLEI BY RELATIVISTIC DEUTERONS AND PROTONS. Baldin, A. M.; Giordeneskii, N.; Zubarev, V. N.; Ivanova, L. K.; Moroz, N. S.; Povtoreiko, A. A.; Radomanov, V. B.; Stavinskii, V. S.; Bondarev, V. K.; Yakovlev, Yu. P. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 5, 1008-1014(May 1975). (In Russian)

Energy spectra are measured for mesons, produced on nuclei D, ^{6}Li, ^{7}Li, C, Al, Cu, ^{144}Sm, ^{154}Sm, ^{182}W, ^{186}W, Pb by deuterons and protons with the momentum of 8.4 GeV/c under the angle π. The experimental values of the invariant cross sections $2Ed^3\sigma/dp^3$ have the properties of scaling invariance and are in agreement with previously detected dependence on the atomic number of the nucleus. At the same energies per nucleon the nuclear fragmentations induced by deuterons and protons are identical within the experimental errors. (4 figures, 3 tables) (auth)

Strong (Meson-induced)

1932 (JINR-E1-8864) INCLUSIVE GAMMA PRODUCTION IN π^-p INTERACTIONS AT 5 GeV/c. Amaglobeli, N. S.; Budagov, Yu. A.; Vinogradov, V. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. Dep. NTIS (US Sales Only) $4.00.

The results of the experimental study of the inclusive reaction $\pi^-p \rightarrow \gamma + \ldots$ at 5 GeV/c are reported. The behavior of the invariant inclusive cross section for γ -quanta in the central and the fragmentation regions was investigated. The conclusion can be made from the comparison of results with data obtained at higher energies that gamma production in π^-p interactions shows the scaling properties already at 5 GeV. (auth)

1933 (JINR-P1-8944) RESOLUTION OF AN EXPERIMENTAL SETUP FOR $\pi^- + p \rightarrow e^+ + e^- + n$ PROCESS STUDIES. Berezhnev, S. F.; Smirnov, G. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The procedure of calculation of kinematical variables for $\pi^- + p \rightarrow e^+ + e^- + n$ process was described. The variables are used both for simulating and for analyzing the experimental data. The problem of choosing the optimal conditions for the process recording by means of two counter telescopes was considered. The instrumental functions of the experimental setup for recording of each kinematical variable are calculated. (auth)

1934 (RL-75-089) NEW DATA AND PARTIAL WAVE ANALYSIS FOR THE REACTION $\pi^-p \rightarrow K^0\Lambda^0$. Abbott, K. W.; Baker, R. D.; Blissett, J. A. (Science Research Council, Chilton (UK). Rutherford Lab.). 1975. 26p. Dep. NTIS (US Sales Only) $4.50.

A spark chamber experiment was performed on the reaction $\pi^-p \rightarrow K^0\Lambda^0$ at 9 incident beam momenta between 0.9 and 1.4 GeV/c. Polarization data at several of the higher momenta are presented. These data fill a gap in existing measurements. A partial wave analysis was performed on all available data.

1935 (RL-75-091) HOW HIGH ARE HIGHER SYMMETRIES AND ψCHOLOGY FOR J-WALKERS. Close, F. E. (Science Research Council, Chilton (UK). Rutherford Lab.). 1975. 68p. Dep. NTIS (US Sales Only) $6.50.

SU(2,3,4,6), SU(6)00(3), the symmetric quark model, and the need for color and charm are described in some detail. A simple minded description of the theoretical background to the search for charm is presented, and the consequences that follow if the recently discovered mesons are associated with charm. The problems that arise for color enthusiasts in their description of the new states are discussed, and it is shown that one can invent a color model that is in good phenomenological agreement with the data (at least on April 1st 1975). This model has some startling predictions (e.g. double and triply charged states) that seem worthy of investigation and if the model is wrong then it can be eliminated empirically fairly soon. (auth)

1936 COHERENT K_S^0 REGENERATION IN HYDROGEN AND DEUTERIUM FROM 3.5 TO 10.5 GeV/c. Freytag, D.; Schultz, C.; Patel, P.; Rippich, C.; Ryan, D.G.; Meyer, S.L.; Cleland, W.E.; Engels, E. (University of Massachusetts, Amherst, Massachusetts 01002). Phys. Rev. Lett. 35: No. 7, 412-416 (18 Aug 1975).

The amplitude and phase for coherent regeneration in hydrogen and deuterium have been measured for six momentum bins in the range 3.5-10.5 GeV/c. Over this region the phase, ϕ_η is consistent with being constant and has the value $-60° \pm 8°$ for hydrogen and $-46° \pm 8°$ for deuterium. Power-law fits of the form $\rho_{\eta n}{}^n$ for the amplitudes when combined with other data given $n = -0.60 \pm 0.02$ for hydrogen and $n = -0.52 \pm 0.02$ for deuterium. (auth)

1937 π^+p POLARIZATION DATA AND THE STRONGLY-CORRELATED-RESONANCES MODEL. Hoff, G.T.; Pappademos, J.N. (Physics Department, University of Illinois at Chicago Circle, Chicago, Illinois 60680). Phys. Rev. D 12: No. 1, 309-312 (1 July 1975).

Further tests of the strongly-correlated-resonances model, involving π^+p elastic polarization data, are reported. (auth)

1938 SCATTERING OF 7-GeV MUONS IN NUCLEI. May, M.; Aslanides, E.; Lederman, L.M.; Limon, P.; Rapp, P.; Entenberg, A.; Jöstlein, H.; Kim, I.J.; Königsman, K.; Kostoulas, I.G.; Melissinos, A.C.; Gittleson, H.; Kirk, T.; Murtagh, M.; Tannenbaum, M.J.; Sculli, J.; White, T.; Yamanouchi, T. (Columbia University, New York, New York 10027). Phys. Rev. Lett. 35: No. 7, 407-410 (18 Aug 1975).

We have measured the inclusive scattering of muons of average energy 7.2 GeV from a variety of nuclear targets in the four-momentum-transfer range $0.6 < Q^2 < 4.0$ $(GeV/c)^2$. We find that the data can be well represented as an incoherent sum of muon-proton and muon-neutron scattering except in the region x $(\equiv 1/\omega = Q^2/2m\nu) < 0.1$ A fit in this region by the form $A_{eff} = \sigma_A/[(Z/A)\ \sigma_p + (N/A)\ \sigma_n] = A^\rho$ yields a value of the exponent ρ of 0.963 ± 0.006. (auth)

1939 DIFFERENTIAL CROSS SECTIONS FOR K^-p ELASTIC SCATTERING FROM 1.4 TO 1.9 GeV/c. Abe, K.; Barnett, B.A.; Goldman, J.H.; Laasanen, A.T.; Steinberg, P.H. (University of Maryland, College Park, Maryland 20742); Marmer, G.J.; Moffett, D.R.; Parker, E.F. Phys. Rev. D 12: No. 1, 6-14 (1 July 1975).

We report here the results from an experiment to obtain differential cross sections for K^-p elastic scattering in the laboratory momentum region from 1.4 to 1.9 GeV/c. These data span the region of a bump in the K^-p total cross section at an energy of 2.05 GeV. Approximately 20 000 elastic events were obtained at each of four momenta with an angular coverage of $0.9 \geq \cos\theta_{c.m.} \geq -0.9$. The data are intended to aid in phase-shift analyses of the resonances causing the bump in the total cross section and to study dip structures at constant values of the Mandelstam variables t and u. (auth)

1940 THRESHOLD BEHAVIOR OF PAIR PRODUCTION AND J(3105), PSI(3695) DOMINANCE. Wu, C. Y.; Chang, C. H. (Inst. of High Energy Physics, Peking). K'o Hsueh T'ung Pao; No. 4, 181-183(1975). (In Chinese).

Since the experimental discovery of long-lived particles J(3105) and ψ(3695), initial theoretical discussions were held. From the results of the analysis, it is believed that J(3105) and ψ(3695) are very possibly the bounded state of positron and electron of new quantum numbers, which exhibit parity to strong interaction. Therefore, hadrons having the new quantum number not equal to zero will certainly exhibit strong interaction with J(3105) and ψ(3695). Particles with the new quantum number not equal to zero have among their electromagnetic shape factors pole points corresponding to long-lived heavy particles J(3105) and ψ(3695). The effect of this shape factor on the threshold behavior of pair production is discussed. Included are four diagrams. (JPRS)

1941 MESON RESONANCE PRODUCTION IN 15 GeV/c pi^+ INTERACTIONS WITH LIQUID HYDROGEN. Kalelkar, M. S. Irvington-on-Hudson, NY; Columbia Univ. (1975). vp. Columbia Univ., Physics Dept., Irvington-on-Hudson, NY. Refer to Nevis Report No. 207.

Thesis (Ph. D.).

A study was made of 200,000 events of all topologies, derived from an exposure of the SLAC 82-in. hydrogen bubble chamber to a beam of 15-GeV/c pi^+ mesons. Events were measured on an automatic machine using newly developed pattern recognition techniques. Resonance production was studied in fitted final states from the 4-, 6- and 8-prong events. A measurement was made of the masses and widths of the rho, f and g mesons, and an isospin assignment of 2 for the g was ruled out by 5 standard deviations. The relative rate of 4 pi to 2 pi decay of the g^0 was calculated. Decay branching ratios of the A_3 to rho pi, f pi and uncorrelated 3 pi were determined, and a measurement was made of the A_3 mass and width in the f pi channel. Evidence was found for a new 3 pi enhancement, called the A_4, which is shown to be a diffractively produced low mass g pi effect, analogous to the A_1 and A_3. Decay branching ratios of the A_4 to rho pi, f pi, g pi and uncorrelated 3 pi were determined, and the mass and width of the A_4 were measured in the g pi channel. A new resonance in the U(2300) region was detected in the $rho^0 rho^0 pi^+$ channel, and measurements were made of its mass, width, and production cross section. The decay branching ratio of the U to rho rho pi was evaluated in two ways. A search for previously claimed resonances above 3 GeV in fitted 6 pi and 7 pi channels yielded negative results, and upper limits on cross sections were determined. A study was also made of the missing mass recoiling from the final state proton in both fitted and unfitted events. Evidence for resonance production in the R(1600-1750) and S(1900-2000) regions was observed, but no narrow higher mass effects are seen. (Diss, Abstr. Int., B)

1942 OBSERVATION OF THE REACTION $\pi^-A \rightarrow 2\pi^+\pi^- m\gamma A$ ON LIGHT NUCLEI. Vasil'kova, A. D.; Gornov, M. G.; Lapushkin, S. V.; Ponosov, A. K.; Protasov, V. P.; Sergeev, F. M. (Moscow Engineering-Physics Inst.). Yadern. Fiz.; 21: No. 5, 1022-1028(May 1975). (In Russian)

The reaction $\pi^-A \rightarrow 2\pi^+\pi^- m\gamma A^*$ (m = 0,1,2...) on light nuclei (C, F, Cl) was investigated at the primary momentum of 3.9 GeV/c. It is shown that the dominating contribution to the reaction in view is from production of the system $2\pi^+2\pi^- m\pi^0$ with subsequent absorption of a negative pion by the nucleus. No process with absorption of the Δ^- isobar is detected. The topological cross sections of the reactions and the cross section of the dominating mechanism are determined. (6 figures) (auth)

1943 EXPERIMENTAL STUDY OF THE DECAY K^0/sub L/ yields $pi^+pi^-pi^0$. Slone, D. N. Stanford, CA; Stanford Univ. (1974). 164p. University Microfilms Order No. 75-6928.

Thesis (Ph. D.).

A 2-meter streamer chamber was located in the neutral 5 degree beam at the Stanford Linear Accelerator Center (SLAC) and was triggered on K-zero-long decays. During 1158 hours of running between July and October of 1970, approximately 2,500,000 events were photographed, 500,000 of which were K-zero-long decays. This report presents an analysis of the purely hadronic K3pi mode based on 20 percent of the total sample (100,000 K-zero-long decays). The decay spectrum was found to depend on the pi-zero center-of-mass kinetic energy (T3) in a manner well described by a matrix element of the form M(+-0) equals a (1 + b(2(T3) - T3 max)/T3 max) where the value of b was determined to be -0.443 +- 0.014. A comparison with K-plus decays shows a significant violation of the delta I equals 1/2 rule for hadronic weak decays. (JFP)

Particle Interactions and Properties (Theoretical)

Refer also to abstract 2063.

1944 STRONG RADIATIVE REACTION IN THE NON-LINEAR COMPTON PROCESS. Stewart, P. (Univ. of Manchester, Eng.). Astron. Astrophys.; 41: No. 2, 169-174(Jun 1975).

The transient behavior of the equations of motion of a charged particle undergoing strong radiative reaction under the influence of an intense electromagnetic field of given phase velocity is examined numerically. Analytical solutions are obtained for the steady oscillatory state for arbitrary phase velocity and field amplitude, and the solutions are used to obtain an estimate of the attenuation length scale for a strong wave propagating through a plasma with strong radiative reaction. The results are used to estimate the charge density required for spatial attenuation of the 30 Hz field in the Crab nebula. (auth)

General

Refer also to abstracts 2065, 2231, 2233, 2234, and 2237.

1945 (AED-CONF-75-197-001) EXPERIMENTS ON NEUTRON–PROTON AND NEUTRON-ELECTRON INTERACTION. Koester, L. (Technische Univ. Muenchen, Garching (F. R. Germany). Reaktorstation). 1975. 19p. (In German). INIS.

From physics colloquium; Karlsruhe, F. R. Germany (16 May 1975).

With figs. and tabs.; 9 refs.

Zero-energy experiments with neutrons, protons and electrons with a wavelength that is considerably longer than the particle expansion are reported. Scattering amplitudes are measured for the reactions n + p and n + e. A neutron gravity refractometer is used. (GE)

1946 EXPERIMENTAL SIGNATURE OF SCALING VIOLATION IMPLIED BY FIELD THEORIES. Tung, W. (Enrico Fermi Institute, Department of Physics, University of Chicago, Chicago, Illinois 60637). Phys. Rev. Lett. 35: No. 8, 490-494 (25 Aug 1975).

Renormalizable field theories are found to predict a surprisingly specific pattern of scaling violation in deep inelastic scattering. Comparison with experiments is discussed. The feasibility of distinguishing asymptotically free field theories from conventional field theories is evaluated. (auth)

1947 COMMENT ON HIGH-ENERGY BEHAVIOR OF NON-ABELIAN GAUGE THEORIES. McCoy, B.M. (Institute for Theoretical Physics, State University of New York, Stony Brook, New York 11794); Wu, T.T. Phys. Rev. Lett. 35: No. 9, 604-605 (1 Sept 1975).

The high-energy behavior of the sixth-order fermion-fermion scattering amplitude in the Yang-Mills theory is recalculated, and found to be qualitatively different from that given previously. (auth)

1948 COLOR GLUONS AND THE DECAY OF THE ψ (3700) INTO ψ (3100). Goldberg, H. (Department of Physics, Northeastern University, Boston, Massachusetts 02115). Phys. Rev. Lett. 35: No. 9, 605-608 (1 Sept 1975).

The decay of ψ (3700) into ψ (3100) plus hadrons constitutes a violation of Zweig's rule. On the assumption that the de-excitation proceeds through the emission of Yang-Mills gluons in a color-singlet state, I predict a width of 190±40 keV for this process. All parameters entering the calculation are taken from previous fits to the decay widths of the ψ (3100). (auth)

1949 CHARGE EXCHANGE OF SECONDARY PIONS PRODUCED BY SLOW HADRON ABSORPTION IN COMPLEX NUCLEI. Bugg, W.M.; Condo, G.T.; Hart, E.L. (Department of Physics and Astronomy, University of Tennessee, Knoxville, Tennessee 37916); Cohn, H.O. Phys. Rev. Lett. 35: No. 9, 611-612 (1 Sept 1975).

Results are discussed from experiments involving the charge-exchange scattering of pions produced in slow-negative-kaon capture. From these, it is shown that pion charge exchange following slow-$\bar{p}$ nucleon capture cannot invalidate the conclusions drawn in recent experiments that there exists a neutron halo in the fringe of heavy nuclei. (auth)

1950 DUALITY VIOLATION AND THE PRODUCTION AND DECAY OF NEW AND OLD MESONS. Bolzan, J.F.; Geer, K.A.; Palmer, W.F.; Pinsky, S.S. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). Phys. Rev. Lett. 35: No. 7, 419-422 (18 Aug 1975).

It is shown that the 0 meson, the $J^P=1^-$ daughter of the Pomeron, is quite successful in predicting a number of rates for duality-violating processes. (auth)

1951 ISOLATING THE EXCHANGES IN MULTIPLE PRODUCTION. Pirilä, P.; Thomas, G.H. (Argonne National Laboratory, Argonne, Illinois 60439); Quigg, C. Phys. Rev. D 12: No. 1, 92-105 (1 July 1975).

We employ rapidity-gap distributions to identify and study the exchanges between hadron clusters produced in collisions at Fermilab energies. The observation of charge exchange disproves the neutral cluster model. At these energies, the data are consistent with the independent emission of clusters of limited charge or with a true limited-charge-exchange picture. For exchange models, two important parameters are identified: the ratio between $|\Delta Q| = 1$ and $\Delta Q = 0$ exchange, and the ratio between the density in rapidity of charged clusters and that of neutral clusters. In principle, both of these quantities are measurable, but with existing data only the first can be determined. We use a unitarity calculation to estimate the second. Given an exchange model which fits rapidity-gap distributions, we obtain a solution to the counting problem in the overlap-function calculation of the energy dependence of two-body charge exchange, and estimate the suppression of charge exchange with respect to elastic scattering. (auth)

1952 HADRONIC SPECTROSCOPY FOR A LINEAR QUARK CONTAINMENT POTENTIAL. Gunion, J.F.; Willey, R.S. (Department of Physics, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). Phys. Rev. D 12: No. 1, 174-186 (1 July 1975).

We investigate the hadronic spectroscopy of a linear confining potential acting between quarks. The resulting systematics are quite satisfactory. In particular the decreasing spacing between radially excited states of a given orbital angular momentum has substantial support in both meson and baryon spectra. (auth)

1953 MODEL OF THE BARE POMERON. Low, F.E. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Rev. D 12: No. 1, 163-173 (1 July 1975).

We present a model of the bare Pomeron. By bare Pomeron we mean a mechanism which accounts for constant total cross sections, zero real parts of scattering amplitudes, and limiting fragmentation (or Feynman scaling). No attempt is made to estimate higher-order corrections, which will presumably generate logarithmic growth, finite real parts, and violation of Feynman scaling. The model can be most clearly formulated in terms of the bag of Chodos *et al.*, although it is probably more general. It consists in the exchange of confined, colored Yang-Mills gluons between confined quarks and appears to account qualitatively for the properties listed above, as well as Gottfried's model of multiplicities in hadron-nucleus collisions. The model in its present form is unable to account for Pomeron factorization. The nonrationalized coupling constant $g^2/4\pi$ is approximately 1/3. (auth)

1954 HADRON MASSES IN A GAUGE THEORY. De Rújula, A.; Georgi, H.; Glashow, S.L. (Lyman Laboratory, Department of Physics, Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. D 12: No. 1, 147-162 (1 July 1975).

We explore the implications for hadron spectroscopy of the "standard" gauge model of weak, electromagnetic, and strong interactions. The model involves four types of fractionally charged quarks, each in three colors, coupling to massless gauge gluons. The quarks are confined within colorless hadrons by a long-range spin-independent force realizing infrared slavery. We use the asymptotic freedom of the model to argue that for the calculation of hadron masses, the short-range quark-quark interaction may be taken to be Coulomb-like. We rederive many successful quark-model mass relations for the low-lying hadrons. Because a specific interaction and symmetry-breaking mechanism are forced on us by the underlying renormalizable gauge field theory, we also obtain new mass relations. They are well satisfied. We develop a qualitative understanding of many features of the hadron mass spectrum, such as the origin and sign of the Σ-Λ mass splitting. Interpreting the newly discovered narrow boson resonances as states of charmonium, we use the model to predict the masses of charmed mesons and baryons. (auth)

1955 IS THE ψ A "RING" STATE? Brower, R.C.; Primack, J.R. (Physics Department, University of California, Santa Cruz, Santa Cruz, California 95064). Phys. Rev. D 12: No. 1, 237-243 (1 July 1975).

We propose that the newly discovered ψ mesons lie on $C = -1$ partners of the daughter trajectories of the Pomeron. Consequently we consider them as excited closed string or ring states of dual or non-Abelian gauge theories. We obtain the mass formula $m_n^2 = 4n/\alpha'$ for the spin 1 daughters of the Pomeron in terms of the universal Regge slope $\alpha' \simeq 0.85\ \mathrm{GeV}^{-2}$, and note that no new mass scale is needed to account for the ψ masses ($m_\psi \simeq m_2$, $m_{\psi'} \simeq m_3$). Our model requires a new symmetry group such as color to account for the narrow width of the observed ψ's. However, the zero quark content of the ring states and the weakness of Pomeron couplings gives further suppression to ψ photoproduction, hadronic ψ production, and some decay modes. (auth)

1956 EFFECTS OF HIGHER-ORDER DIFFRACTIVE PROCESSES IN AN ABSORPTIVE EIKONAL MODEL. Schaffner, J.G.; Camillo, P.J.; Fishbane, P.M.; Trefil, J.S. (Department of Physics, University of Virginia, Charlottesville, Virginia 22901). Phys. Rev. D 12: No. 1, 244-261 (1 July 1975).

We investigate the effects of opening diffractive channels on elastic scattering and diffractive production. Using a type of field-theoretic calculation in the eikonal approximation, we derive general expressions for elastic and diffractive amplitudes. We show that an explicit counting of all contributing graphs is completely equivalent to diagonalization procedures of a multichannel eikonal. By demanding that the calculated cross sections satisfy $(\sigma_{el} + \sigma_{diff}) \leq \sigma_{tot}$, we find that for a given absorption an upper bound exists on the ratio of diffractive to elastic coupling strengths. With this relation we derive the following results: (1) For a black-disk absorption profile, $1/8 \leq \sigma_{el}/\sigma_{tot} \leq 1/2$ and $0 \leq \sigma_{diff}/\sigma_{tot} \leq 3/8$; (2) for a Gaussian-shaped profile, $\sim 0.06 \leq \sigma_{el}/\sigma_{tot} \leq 0.25$ and $0 \leq \sigma_{diff}/\sigma_{tot} \leq \sim 0.91$. Bounds for $(\sigma_{el} + \sigma_{diff})/\sigma_{tot}$ are also investigated. (auth)

1957 CALCULATION OF ANOMALOUS MAGNETIC MOMENTS OF STRANGE BARYONS. Deo, B.B.; Singh, L.P. (Physics Department, Utkal University, Bhubaneswar-751004, Orissa, India). Phys. Rev. D 12: No. 1, 262-271 (1 July 1975).

Sidewise dispersion relations are used to calculate the anomalous magnetic moments of strange baryons. The absorptive parts of the relevant form factors are related to the real parts of the photoproduction amplitudes. Assuming that the absorptive part is given correctly by the lowest intermediate meson-baryon state, the low-lying resonances below inelastic threshold, and a high-energy fall-off calculated by Reggeizing the photoproduction amplitude, we obtain the imaginary parts for all energies by extrapolation using a suitable conformally mapped variable. Values for the anomalous magnetic moments are obtained which are significantly different from the SU(3) predictions. In nuclear magnetons, the results are $\kappa_\Lambda = -0.545$, $\kappa_{\Sigma^0} = 0.4$, $\kappa_{\Sigma\Lambda} = 0.97$, $\kappa_{\Sigma^-} = -0.493$, $\kappa_{\Sigma^+} = 1.293$, $\kappa_{\Xi^-} = -0.297$, $\kappa_{\Xi^0} = -0.214$, in fair agreement with recent experimental values for these moments. (auth)

1958 HYDRODYNAMICAL MODEL WITH MASSLESS CONSTITUENTS. Chiu, C.B.; Wang, K. (Center for Particle Theory, Department of Physics, University of Texas, Austin, Texas 78712). Phys. Rev. D 12: No. 1, 272-276 (1 July 1975).

Within the constituent hydrodynamical model, we show that the total number of constituents is conserved, if these constituents are massless and satisfy the Fermi-Dirac distribution. We suggest a simple scheme for the transition from the constituent phase to the hadron phase and present the hadron inclusive momentum spectra for this case. (auth)

1959 SPIN TESTS FROM ANGULAR CORRELATIONS IN SEQUENTIAL DECAYS. Daumens, M.; Massas, G.; Minnaert, P. (Laboratoire de Physique Théorique, Université de Bordeaux I, Gradignan, France). Phys. Rev. D 12: No. 1, 291-295 (1 July 1975).

We formulate precisely the principle of spin tests from angular correlations in sequential decays. We show that the spin tests for bosons proposed by Ademollo, Gatto, and Preparata for canonical frames and by Berman, Jacob, and Chung for helicity frames are equivalent. (auth)

1960 COVARIANT HARMONIC OSCILLATORS AND EXCITED MESON DECAYS. Kim, Y.S. (Center for Theoretical Physics, Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Noz, M.E. Phys. Rev. D 12: No. 1, 129-138 (1 July 1975).

We use the covariant harmonic-oscillator wave functions to formulate the vacuum quark-pair-creation model of three-meson vertices and meson-decay matrix elements. It is pointed out first that the harmonic-oscillator wave functions can be given a covariant probability interpretation. We then use this probability concept to construct the three-meson vertex function. Using a relativistic *L-S* coupling scheme, we calculate the decay amplitudes for the $B \to \omega\pi$ and $A_1 \to \rho\pi$ decays. For the B decay, the calculated polarization ratio turns out be in excellent agreement with the experimental value. For the A_1 decay, the calculated ratio is consistent with the present experimental value. We have also calculated the decay ratio for the well-established $\rho \to \pi\pi$ and $A_2 \to \rho\pi$ decays. It is shown that the harmonic-oscillator wave functions produce a number which is very close to the experimental value. The limitations of the *L-S* coupling scheme are discussed. (auth)

1961 COVARIANT HARMONIC OSCILLATORS AND DIFFRACTIVE EXCITATIONS. Kim, Y.S. (Center for Theoretical Physics, Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Noz, M.E. Phys. Rev. D 12: No. 1, 122-128 (1 July 1975).

We use convariant harmonic-oscillator wave functions to describe quark-model hadrons in Glauber's model of diffractive scattering. It is shown that the Glauber model can be constructed in the center-of-mass system in terms of fully covariant quantities. For elastic scattering, the covariant model gives the same result as that using nonrelativistic harmonic-oscillator wave functions. For the transition from the $n = 0$ to $n = 2$ states, which includes the diffractive excitations to the N (1470) and N (1690) resonances, the relativistic effect is simply a multiplication of the nonrelativistic amplitude by the factor $(1 - \alpha^2)$, α being the velocity difference between the incoming nucleon and the final-state resonance. We discuss the effects of these results on the existing nonrelativistic calculations. (auth)

1962 MASS FORMULA FOR MESONS AND BARYONS WITH ALLOWANCE FOR CHARM. Sakharov, A.D. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). JETP Lett. 21: No. 9, 258-259 (5 May 1975).

The mass formula previously proposed by Ya. B. Zel'dovich and the author for mesons and baryons is applicable to particles that have charm. (auth)

1963 POSSIBILITY THAT CHARMED VECTOR MESONS ARE LIGHTER THAN CHARMED PSEUDOSCALARS. Altarelli, G.; Cabibbo, N. (Istituto di Fisica dell'Università, Roma, Italy); Maiani, L. Phys. Rev. Lett. 35: No. 10, 635-638 (8 Sept 1975).

In view of the possible observation at SPEAR of events which could be interpreted as the production of charmed mesons followed by decays into purely leptonic channels, we suggest the possibility that the stable charmed mesons may be vectors rather than pseudoscalars. Estimates of decay rates and branching ratios are given in this case. (auth)

1964 INSTABILITY OF AN $\Omega\bar{\Omega}$ MODEL OF THE Ψ. Shapiro, J.A. (Department of Physics, Rutgers University, New Brunswick, New Jersey 08903). Phys. Rev. Lett. 35: No. 10, 623-625 (8 Sept 1975).

On the assumption that the ψ is an $\Omega\bar{\Omega}$ bound state, we find that the expected widths for $\psi \to \Xi\bar{\Xi}$, though dependent on the wave-function assumptions, are likely to be orders of magnitude bigger than experimentally allowed. (auth)

1965 SEARCH FOR CHARMED PARTICLES. Iwasaki, Y. (Department of Physics, University of Tsukuba, Ibaraki, 300—31, Japan). Phys. Rev. Lett. 35: No. 11, 749-752 (15 Sept 1975).

It is suggested that the channels Σ^+K^-, $\Sigma^-\pi^+$, and $\Xi^-\pi^+$ in the mass region 2.3–2.5 GeV, but not the channels π^+K^+ and pK^-, be examined in a search for neutral charmed particles. (auth)

1966 FOLDY-WOUTHUYSEN TRANSFORMATIONS FOR ANY SPIN. Guertin, R.F. (Physics Department, Rice University, Houston, Texas 77001). Ann. Phys. (N.Y.) 91: No. 2, 386-412 (June 1975).

We give the generalized Foldy–Wouthuysen transformation for any $2(2J+1)$ -component Poincaré-invariant Hamiltonian theory that describes free massive spin-J particles and that is subject to the conditions: (a) every observable $\mathcal{O}$ is either Hermitian ($\mathcal{O}=\mathcal{O}^\dagger$) or pseudo-Hermitian ($\mathcal{O}=\rho_3\mathcal{O}^\dagger\rho_3$) and (b) the theory is invariant under the discrete symmetries. The requirement that the Hamiltonian be defined in the rest frame specifies one and only one boost generator that is also defined at $\mathbf{p} = 0$. (auth)

1967 THEORY OF MORPHISMS BETWEEN THE TARDYONS AND TACHYONS. Chiang, C. H. Wu-li; 4: No. 2, 119-125 (18 Apr 1975). (In Chinese).

The space cycle from the general Lorentz transformation is introduced and used to study the kinematics and dynamics of tardyons and tachyons. A coexistence theory is then proposed to establish a unified theory of tardyons and tachyons. Three conditions of space transformation are discussed, namely: the space-time transformation between the tardyons; the space-time transformation between the tachyons; and the space-time transformation between the tardyons and the tachyons. It is proved that there is no static mass in the tachyons, the action of which is substituted by the pseudo-static momentum $\vec{P}_\infty$. It is pointed out also that the horizontal momentum in high energy accelerator is the result of tachyon action. (JPRS)

1968 DEEP INELASTIC SCATTERING AND THE STRATON MODEL. Ho, T. C.; Chang, C. H.; Hsieh, I. C. (Inst. of High Energy Physics, Peking). Wu Li Hsueh Pao; 24: No. 2, 115-123(Mar 1975). (In Chinese).

The high energy electronic deep inelastic phenomenon is discussed on the basis of the straton model. So long as there is point charge, the result coincides with that from pencil algebra. It is pointed out also that the solution to the contradiction between theory and experiments will depend upon further development of new theories. (auth)

1969 NEW NEUTRAL BOSON AND THE GAUGE MODELS OF WEAK INTERACTIONS. Novikov, V. A. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 21: No. 5, 1062-1063(May 1975). (In Russian)

Introduction of light neutral intermediate bosons into the Georgi–Glashow model is considered resulting in the neutral-current effective coupling of the order of magnitude of the Fermi coupling constant. Possible universality of the effective four-fermion constants at strong violation of universality of the original interactions is discussed. (auth)

1970 SUM RULES IN THE RANDOM PHASE APPROXIMATION. Semenko, S. F. (Lebedev Inst. of Physics, Moscow). Yadern. Fiz.; 21: No. 5, 977-986(May 1975). (In Russian)

A simple formula for the quantities $\Sigma[(O|F|N)(N|\phi|O) + (-1)^k(O|\phi|N)(N|F|O)]E_N^k$ $(O \leq k \leq 3)$ where F, ϕ are the one-body local operators, are obtained from the random phase ap-

proximation equations. The obtained relations are used to calculate the energies of electric multipole resonances and to derive an equation for the collective coordinate. The sum rules for the Tamm–Dankov method are also given. (auth)

1971 SPONTANEOUS VACUUM TRANSITIONS IN DUAL THEORIES. Volkov, D.; Zheltukhin, A. A.; Pashnev, A. I. (Physical-Technical Inst., Kiev). Yadern. Fiz.; 21: No. 5, 1104-1116(May 1975). (In Russian)

The existence of spontaneous vacuum transitions in dual theories is discussed. It is shown that in a dual model with $\alpha_0 = -1$ such transitions exist. (3 figures) (auth)

1972 MODEL FOR ABSORPTION OR DECAY. Davies, E. B. (Univ. of Geneva). Helv. Phys. Acta; 48: 365-381(1975).

The gradual absorption or decay of a single quantum-mechanical particle by means of a simple model consisting of a one-parameter contraction semigroup on a Hilbert space. As well as relating the work to quantum-mechanical measurement theory, the evolution equation for the particle in the classical limit is found. (auth)

1973 QUARKS WITH COLOR AND FLAVOR. Glashow, S. L. Sci. Am.; 233: No. 4, 38-50(Oct 1975).

The three kinds of quarks, arbitrarily assigned different flavors and colors, are discussed in relation to the structure of particles. (JFP)

Electromagnetic

Refer also to abstracts 1932 and 2236.

1974 (KFKI-75-45) TIME-DEPENDENT MAXWELL FIELDS IN STATIONARY GEOMETRY. Lukacs, B.; Perjes, Z. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Jul 1975. 13p. Dep. NTIS (US Sales Only) $4.00.

The following question is posed: to what extent does the stationarity of the space-time restrict the time dependence of the electromagnetic field in the absence of currents? The field equations of the system are derived. These equations contain, as a special case, the stationary electrovac problem. It is shown that a phase factor in the Maxwell field can depend on time. Either this factor is of the form $\theta = \epsilon t$ or the electromagnetic field is type N. An exact particular solution of the problem belonging to Kundt's metrics is found. (auth)

1975 ACCURATE ACCOUNT OF ELECTRON INTERACTION IN AN OSCILLATORY FIELD. Lozanskij, Eh. D.; Firsov, O. B. Izv. Vyssh. Ucheb. Zaved., Fiz.; 6: No. 145, 52-54(1974). (In Russian).

For English translation see the journal Sov. Phys. J.

A look is taken at the case of an accurate solution of the Schroedinger equation for a system of two interacting electrons in a spherical, oscillatory field. On the basis of this solution an estimate of the accuracy of the Hartree–Fock method is carried out. (tr-SJR)

1976 THE MASS DIFFERENCE OF THE ELECTRON AND THE MUON. Novello, M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro); Armony, M. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil)). Notas Fis., Cent. Bras. Pesqui. Fis.; 19: No. 3, 96-101(1972).

Realizing that cosmology may play a role in the properties of the elementary particles, an attempt is made to look for an explanation of the mass difference of the electron and the muon in the actual structure of the universe. The origin of the muon and the electron mass is considered. Methods of experimental verification are presented. A relation is given between the masses of the leptons and the dependence of the value of these masses on the structure of the universe. (auth)

1977 MESON EXCHANGE CURRENTS IN DEUTERON ELECTRODISINTEGRATION AND THE NUCLEON AXIAL VECTOR FORM FACTOR. Lock, J. A. Cleveland; Case Western Reserve Univ. (1974). 153p. University Microfilms Order No. 75-5067.

Thesis (Ph. D.).

Double differential cross sections for deuteron electrodisintegration near threshold from backscattered electrons were calculated for electron four-momentum transfer squares in the range 0 less than or equal to DELTA^2 less than or equal to 15 Fm^{-2} and for final n-p relative energies in the range 0 less than or equal to E/sub rel/ less than or equal to 15 MeV using the Reid hard core parameterization of the n-p potential and considering the free nucleon or impulse process and various one pion exchange processes. Particular attention was paid to the study of the form factors of the mesonic processes and to the dependence of the cross section on various n-p potentials. In particular, the cross section was found to be dominated by the impulse process for DELTA^2 less than or equal to 8 Fm^{-2} and by the catastrophic meson exchange process for DELTA^2 greater than or equal to 8 Fm^{-2}. Since in dispersion theories, the catastrophic process is proportional to the isovector Dirac nucleon form factor F$_1$/sup v/(DELTA^2) while in PCAC-current algebra theories it is proportional to the nucleon axial vector form factor F/sub A/(DELTA^2), a determination of the catastrophic form factor was undertaken. It was found that the experimental data were reasonably fitted by F/sub A/(DELTA^2) equals (1 + DELTA^2/m^2/sub A/)$^{-2}$ with m/sub A/ equals .81 GeV. This value of m/sub A/ is within the range of values determined from neutrino scattering experiments. Further, the cross section was found to be relatively insensitive to the n-p potential employed providing it exhibits repulsive core behavior for r less than or approximate to .5 Fm. Finally, possible parameterizations of the off-shell contributions to the pion form factor were examined as well as were contributions to the cross section from scattering to the $^3S_1$ - $^3D_1$ and l greater than 0 final states. (Diss. Abstr. Int., B)

1978 SUM RULES FOR SINGLE-PION ELECTROPRODUCTION FROM LIGHT-CONE COMMUTATION RELATIONS. Dicus, D.A. (Center for Particle Theory, The University of Texas at Austin, Austin, Texas 78712). Phys. Rev. D 12: No. 1, 277-285 (1 July 1975).

Light-cone current commutation relations are used to derive fixed-mass sum rules on the amplitudes for the electroproduction of single pions. These sum rules should provide a more direct test of the structure of the commutation relations than the sum rules previously derived. (auth)

1979 e^+e^- ANNIHILATION INTO HADRONS AND COLLISIONS WITH NUCLEI IN THE HYDRODYNAMIC THEORY OF MULTIPLE PRODUCTION. Shuryak, E.V. (Nuclear Physics Institute, Siberian Division, USSR Academy of Sciences). JETP Lett. 21: No. 8, 232-233 (20 Apr 1975).

Simple estimates are presented for a number of characteristics of the indicated reaction within the framework of the hydrodynamic approach. The experimental data are in qualitative agreement with these estimates, and deviate in a number of respects from the conclusions of the parton model. (auth)

1980 GENERALIZED SCALING IN INCLUSIVE e^+e^- ANNIHILATION AND PION FORM FACTOR. Sato, H. (Center for Theoretical Physics, Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). Phys. Rev. D 12: No. 1, 71-76 (1 July 1975).

It is shown that the inclusive e^+e^- annihilation process, $e^+e^- \to \pi$ + anything, reveals scaling behavior if we use the generalized scaling variable introduced by Bloom and Gilman in the analysis of the deep-inelastic scattering data. The scaling function is related to the pion form factor through the inclusive-exclusive connection. We derive a sum rule which relates the pion form factor to the scaling function. (auth)

1981 SOME STRONG AND ELECTROMAGNETIC MESON DECAYS. Parashar, D.; Dobson, P.N. Jr. (Department of Physics and Astronomy, University of Hawaii, Honolulu, Hawaii 96822). Phys. Rev. D 12: No. 1, 77-81 (1 July 1975).

Some strong and electromagnetic decay processes of mesons are studied in the context of Mitra's version of the relativistic quark model involving broken SU(6) $\times$ O(3) group structure in conjunction with Schwinger's technique of partial symmetry and the hypothesis of vector-meson dominance. In particular, we calculate the decay rates and the corresponding branching ratios for the processes $(A_1, A_2) \to \gamma\pi$, $\omega\pi\pi$; $B \to \gamma\pi$, $\rho\pi\pi$; $\omega \to 3\pi$; $\eta \to \pi^0\gamma\gamma$, $\pi\pi\gamma$; and $\pi^0 \to 4\gamma$. Comparison of the predicted results with experiment is discussed. (auth)

1982 REMARKS ON e^+e^- ANNIHILATION INTO HADRONS IN QUANTUM FIELD THEORY. Cheng, H. (Department of Mathematics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139); Wu, T.T. Phys. Rev. D 12: No. 1, 302-304 (1 July 1975).

We show that the absorptive effect of particle production on e^+e^- annihilation reactions is to reduce the cross sections and give a constant value to $R = \sigma(e^+e^- \to \text{hadrons})/\sigma(e^+e^- \to \mu^+\mu^-)$. In the approximation of summing leading terms, this effect simply gives a factor $s^{-\epsilon}$ to all cross sections. (auth)

1983 SOME CONSEQUENCES CONCERNING THE NEW RESONANCE DISCOVERED IN e^+e^- ANNIHILATION. Moffat, J.W. (Department of Physics, University of Toronto, Toronto, Ontario, Canada M5S 1A7). Phys. Rev. D 12: No. 1, 286-287 (1 July 1975).

The new resonance discovered in e^+e^- annihilation at $M_\psi \simeq 3.1$ GeV is identified as one of the "missing" vector mesons in SU(4). We discuss some consequences of assigning this particle to the adjoint representation $\underline{63}$ of SU(8), assuming strong interactions are spin- and SU(4) -unitary-spin-independent. By assuming quark-spin conservation in SU(8), we obtain selection rules for the resonance ψ which explain, in a simple manner, the observed narrow width $\Gamma_\psi \leq 1.9$ MeV. (auth)

1984 J (3.1) AND ψ (3.7): HOW ABOUT COLOR? Krammer, M.; Schildknecht, D.; Steiner, F. (Deutsches Elektronen-Synchrotron

DESY, Hamburg, Germany and II. Institut für Theoretische Physik der Universität Hamburg, Hamburg, Germany). Phys. Rev. D 12: No. 1, 139-146 (1 July 1975).

The new particles J (3.1) and ψ (3.7) are interpreted as colored ω and ϕ mesons, respectively. By relating the radiative decay J (3.1) $\rightarrow \eta\gamma$ to 2γ decays of the color singlet mesons π^0, η, X^0, we find that the radiative decay J (3.1) $\rightarrow \eta\gamma$ is suppressed (in contrast to simple expectations from $\omega \rightarrow \pi^0\gamma$). Via "strong new duality" we predict the recurrences J' (4.18 ± 0.08), J'' (5.03 ± 0.13),... and ψ' (4.63 ± 0.08), ψ'' (5.41 ± 0.13),... . (auth)

1985 DECAYS OF ψ MESONS. Feinberg, G. (Department of Physics, Columbia University, New York, New York 10027). Phys. Rev. D 12: No. 1, 109-112 (1 July 1975).

It is suggested that most of the "hadronic" width of the ψ (3.1 GeV) is actually due to radiative decays into ordinary hadrons. Estimates of these decays based on vector dominance and the medium-strong ψ-ψ-hadron coupling give keV widths for various radiative modes, comparable to the 54 keV of width that is not accounted for by 1γ intermediate states. Various tests of the hypothesis that ψ mesons do not interact linearly with ordinary hadrons are proposed. (auth)

1986 BREMSSTRAHLUNG IN RESONANT MOTION OF RELATIVISTIC ELECTRONS. Andreev, Yu.A.; Davydovskii, V.Ya. (Taganrog Radiotechnical Institute). Sov. Phys.—Tech. Phys. 20: No. 1, 1-4 (July 1975).

An elementary theory is considered for the resonant slowing down of electrons by the field of an electromagnetic wave in a constant external magnetic field; the name "arttron" effect is given to the phenomenon. The simple case in which the wave amplitude is constant and quantum effects are negligibly small is considered. Conditions are found for the complete transfer of kinetic energy from the electrons to the electromagnetic wave. The allowable deviations in the initial conditions are estimated. (auth)

1987 BARYONIC ELECTROMAGNETIC PROPERTIES AND THE PHENOMENA OF THE Δ(1236) PHOTO- AND ELECTRO-PRODUCTION IN THE STRATON MODEL. Li, P. A. (Inst. of High Energy Physics, Peking). Wu Li Hsueh Pao; 24: No. 2, 124-140(Mar 1975). (In Chinese).

The straton model calculation method and the baryonic wave function from previous work are used to discuss the $\frac{1}{2}^+$ baryonic electromagnetic properties and the Δ(1236) photogenic and electrogenic phenomena. The Bethe-Salpeter baryonic equation is further utilized to obtain the scalar coupling and gradient approximation, when two proportional invariable functions in the baryonic wave function are obtained. On this basis, when $G_M^{\Lambda}(q^2)$, μ_p and μ_Λ are taken as the input, $\mu_p G_E^p(q^2)/G_M^p(q^2)$, $G_E^n(q^2)$ and $p \rightarrow \Delta^+(1236)$ of $G_{M,+}(q^2)$, μ, E1+ and S1+ can be more satisfactorily explained. The slope ($q^2 = 0$ point) of the neutron charge shape derived is 30 to 40% higher than experiment, while $\mu\Sigma^+$ is 30 to 40% lower than experiment. (auth)

1988 COLLIDING-BEAM RESULTS OF ELECTRON–POSITRON ANNIHILATION AND THE INTERACTIONS OF SUPER-NARROW RESONANCES PSI. Lo, L. F.; Lu, T. (Inner Mongolia Univ.). Wu Li Hsueh Pao; 24: No. 2, 145-150(Mar 1975). (In Chinese).

An explanation is derived for the expansion of R = [($e^+e^- \rightarrow$ boson)/($e^+E^- \rightarrow \mu^+\mu^-$)] with energy, the active properties of the newly discovered ψ particles are studied, and it is pointed out that its strength is $(f^2/4) \sim 10^{-5}-10^{-4}$. Also, the peak value section $\bar{\sigma}_0 = (12\pi/M_\psi^2)[\Gamma(\psi \rightarrow e^+e^-)/\Gamma\ \mathrm{tot}]$ is obtained, and it is pointed out that the true width of ψ is one magnitude lower than the experimental upper limit. A discussion is also made on the relation between the visual width ΔE of ψ, the mean peak value section $\bar{\sigma}_0$, and the mass M_ψ, when $\bar{\sigma}_0 \Delta E M_\psi^4$ = constant obtained coincides with the experimental results. (auth)

1989 DISCUSSION ON THE $\pi^0-2\gamma$ DECAY MECHANISM. Chu, C. Y. (Inst. of Mathematics, Peking). Wu Li Hsueh Pao; 24: No. 2, 141-144(Mar 1975). (In Chinese).

Some common physical mechanism of $\pi^0 \rightarrow 2\gamma$ decay is studied on the basis of the straton model. The contributions of these mechanisms are also evaluated under the assumption that the mass of the straton is very high. (auth)

1990 PRODUCTION OF THE EPSILON MESON IN e^+e^- COLLISIONS. Budnev, V. M.; Vall, A. N.; Serebryakov, V. V. (Inst. of Mathematics, Moscow). Yadern. Fiz.; 21: No. 5, 1033-1041(May 1975). (In Russian)

A dispersion model is constructed for the amplitude of $\gamma\gamma \rightarrow \pi\pi$ process with J = I = 0. It is shown that using the expansion of the amplitude in agreement with the current algebra and PCAC at $s \simeq 0$ to normalize the solution of the dispersion equation one is able to obtain the s-wave amplitude up to $s = 900\ \mathrm{MeV}^2$. Based on the obtained solution the question on deviation of the cross section $d\sigma/d\cos\theta$ at $\theta = 90°$ from the one-pion approximation is considered. The cross section $d\sigma/d\cos\theta$ at $\theta \simeq 90°$ is most of all fitted for observation in the contemporary colliding-beam e^+e^- experiments. The value of $d\sigma/d\cos\theta$ is larger than the Born cross section by a factor that is no more than 1.5–2. (4 figures) (auth)

1991 POLARIZATION EFFECTS IN PHOTOPRODUCTION OF A_1 MESONS. Shakhazaryan, Yu. G. (Erevan Inst. of Physics). Yadern. Fiz.; 21: No. 5, 1042-1045(May 1975). (In Russian).

General discussion of photoproduction of A_1 mesons on nucleons induced by polarized γ-quanta is presented. Formulae are obtained for analysis of the angular distribution of the $A_1 \rightarrow 3\pi$ decay products in terms of the A_1-meson density matrix elements ρ^α (α = 0, 1, 2, 3) that are introduced in case of the A_1-meson production induced by polarized photons. It is shown that in this case one is able to find a contribution to the matrix $\rho(A_1)$ from the t-channel exchanges with natural and unnatural parity, as well as to obtain a total description of the polarization state of the produced A_1 meson. (1 figure) (auth)

1992 MULTILOOP DIAGRAMS IN DUAL-RESONANCE MODEL. Gedalin, E. V.; Gurvich, E. G. (Inst. of Physics, Tbilisi, USSR). Yadern. Fiz.; 21: No. 5, 1093-1103(May 1975). (In Russian)

It is shown that the usual procedure of sewing together the tree diagrams, expanded also to the primitive operators, enables one to obtain the explicit form of an arbitrary multiloop diagram in the dual-resonance model. As an example, the sewing of the N-reggeon vertex with an arbitrary number of the planar tadpoles is considered in some detail. The problem of removal of the divergences from the multiloop amplitudes is discussed and a simple prescription how to calculate corresponding counter-terms is presented. The described procedure may be easily generalized to the case of any dual model. (3 figures) (auth)

1993 LINEAR POLARIZATION OF X-RAY BREMSSTRAHLUNG AT ELECTRON ENERGIES FROM 0.5 TO 1.5 MeV. Lichtenberg, W. Wuerzburg, Ger.; Wuerzburg Univ. (1974). 64p. (In German). INIS.

Thesis.

The measurement of the linear polarization of x-ray bremsstrahlung is described at electron energies of 0.5, 1.0, and 1.5 MeV. The spectral dependence of the degree of polarization on thin targets of Be, Al, Ag, and Au was investigated under photon emission angles from 10° up to 122°. The measuring technique used the polarization sensitivity of the Compton effect. In the whole spectrum a strong dependence of the degree of polarization on the mass number was obtained. (auth)

Weak

1994 (ANL/HEP/PR-75-45) PHENOMENOLOGY OF NEUTRINO REACTIONS. Sehgal, L. M. (Argonne National Lab., Ill. (USA)). Aug 1975. 85p. Dep. NTIS $7.25.

A review of neutrino reactions is given with sections devoted to the following topics: scattering of neutrinos by electrons; scattering of neutrinos by nucleons, exclusive reactions; scattering of neutrinos by nucleons, inclusive and semi-inclusive reactions; neutrinos and partons. (7 figures, 57 references) (SDF)

1995 IMPLICATIONS OF RECENT DATA ON $\Sigma^- \rightarrow ne^-\nu$ FOR THE CABIBBO MODEL. Garcia, A. (Departamento de Fisica, Centro de Investigación y de Estudios Avanzados, Instituto Politécnico Nacional, México 14, D. F.); Swallow, E.C. Phys. Rev. Lett. 35: No. 7, 467-469 (18 Aug 1975).

A recent measurement of the electron-neutrino angular correlation in $\Sigma^- \rightarrow ne\nu$, taken by itself, is shown to be in remarkable agreement with the Cabibbo model. In contrast, the electron-spin asymmetry combines with it to distinctly favor the *wrong sign* for the axial-vector-to-vector form-factor ratio. (auth)

1996 ASYMPTOTIC NEUTRINO CROSS SECTIONS. Shifman, M.A. (Institute of Theoretical and Experimental Physics). JETP Lett. 21: No. 8, 230-231 (20 Apr 1975).

The asymptotic behavior of neutrino cross sections is discussed within the framework of field theory. It is shown that if strong interactions are described by a theory that has either asymptotic freedom or a fixed point, and if the weak interactions (in the four-fermion form) are taken into account only in first order, then the neutrino cross sections increase linearly with increasing neutrino energy. (auth)

1997 WEAK DECAYS OF CHARMED HADRONS. II. SOFT-MESON THEOREMS. Kingsley, R.L.; Treiman, S.B.; Wilczek, F.A.; Zee, A. (Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540). Phys. Rev. D 12: No. 1, 106-108 (1 July 1975).

Soft-meson theorems, inclusive and exclusive, are derived for weak nonleptonic decay of charmed hadrons in the context of the four-quark model of weak interactions. (auth)

1998 GENERAL SPACE-TIME STRUCTURE OF THE NEUTRAL-CURRENT INTERACTIONS. Pakvasa, S.; Rajasekaran, G. (Department of Physics and Astronomy, University of Hawaii, Honolulu, Hawaii 96822). Phys. Rev. D 12: No. 1, 113-121 (1 July 1975).

We present a general analysis of the neutral-current inclusive cross section taking into account all the covariants (scalar, pseudoscalar, tensor, vector, and axial-vector) in the interaction. We derive the model-independent formula for the inclusive cross section and we also discuss the consequences of various models. We deduce bounds on the ratio $R \equiv \sigma(\bar{\nu}N)/\sigma(\nu N)$ in the case in which scaling is true, i.e., the inclusive cross section at high energies is proportional to the incident neutrino energy E. The scaling violations arising from spin + 1/2 partons and the bounds of R in that case are also discussed. (auth)

1999 WEAK CURRENT IN HARARI'S HEAVY-QUARK MODEL. Pakvasa, S.; Simmons, W.A.; Tuan, S.F. (Department of Physics and Astronomy, University of Hawaii at Manoa, Honolulu, Hawaii 96822). Phys. Rev. Lett. 35: No. 11, 702-704 (15 Sept 1975).

We show that by adding a $V+A$ heaviness-changing current to Harari's proposed current, the good results of Harari as well as of De Rújula, Georgi, and Glashow are retained. In addition, our proposal explains the observed γ anomaly in $\bar{\nu}$ interactions. Other consequences of the model are also discussed. (auth)

2000 NEW CHARM-CURRENT EFFECTS IN NEUTRINO SCATTERING. Barger, V.; Weiler, T. (Department of Physics, University of Wisconsin, Madison, Wisconsin 53706); Phillips, R.J.N. Phys. Rev. Lett. 35: No. 11, 692-695 (15 Sept 1975).

We investigate the quantitative implications for deep inelastic neutrino scattering of a proposed additional $V+A$ charm-changing current $\bar{c}\gamma_\mu(1-\gamma_5)\,d$. Quark-parton-model spectrum-averaged predictions are compared with available νN and $\bar{\nu}N\nu$ distributions as obtained at Fermilab. Agreement is achieved with an effective charm threshold $W_{th}=4$ GeV. A characteristic feature is an enhanced sea contribution that can account for the anomaly in $d\sigma/dy$ for $\bar{\nu}N$. Predictions for sum rules are significantly changed at high energy. (auth)

2001 MEASUREMENTS OF SELECTED Ψ (3684) BRANCHING RATIOS FROM A STUDY OF SECONDARY LEPTON PAIRS. Hilger, E.; Beron, B.L.; Ford, R.L.; Hofstadter, R.; Howell, R.L.; Hughes, E.B.; Liberman, A.D.; Martin, T.W.; O'Neill, L.H.; Simpson, J.W. (High Energy Physics Laboratory and Department of Physics, Stanford University, Stanford, California 94305); Resvanis, L.K. Phys. Rev. Lett. 35: No. 10, 625-628 (8 Sept 1975).

We determine the ratio of the partial decay width for ψ (3684) $\to\mu^+\mu^-$ to that for the cascade decay ψ (3684) $\to\psi$ (3095)$+X$ to be (1.4±0.3) % and, by direct observation of associated charged particles and γ rays, find the ratio of the partial decay width for ψ (3684) $\to\psi$ (3095)$+\pi^0\pi^0$ to that for ψ (3684) $\to\psi$ (3095)$+\pi^+\pi^-$ to be 0.64±0.15. (auth)

2002 ARE HEAVY LEPTONS FOUND? De Rújula, A.; Georgi, H.; Glashow, S.L. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. Lett. 35: No. 10, 628-631 (8 Sept 1975).

Recently reported observations suggest the existence of a new particle without strong interactions. We interpret it as a massive neutral lepton L^0 produced by decays of a new charged lepton L^+ which in turn is pair-produced electromagnetically by cosmic rays. The mass of L^+ must be ~2 GeV; the lifetime of L^0 must be $\sim 10^{-3}$ sec. Possible gauge models incorporating the new leptons are discussed, as are other experimental consequences. (auth)

2003 NON-LEPTONIC DECAYS OF STRANGE PARTICLES IN THE STRATON MODEL. Lo, L. F.; Lu, T. (Inner Mongolia Univ.). Wu Li Hsueh Pao; 24: No. 2, 105-114(Mar 1975). (In Chinese).

The nonleptonic decay of strange particles is analyzed in the straton model, the dynamic mechanism that leads to decay is derived, and it is pointed out that, under the conceptions of structure model and current coupling, the ultimate point of vector meson cannot be used to treat the S wave and κ-2π decay of hyperons. It is proved that the S wave and the P amplitude of hyperon nonleptonic decay can be completely expressed by the parameters of two representative structural effects that reflect the probability of straton in bosons, and that by suitably selecting two parameters will enable a fair explanation of hyperon nonleptonic decays and other experiments. Some relations of κ-2π decay amplitude are derived on the basis of the structural model which coincide with the results of current algebra. Also the adherence of the straton to Bose and Fermi statistics respectively, is discussed, the results of which are the same. (auth)

2004 WEAK INELASTIC PRODUCTION AND LEPTONIC DECAYS OF HEAVY LEPTONS. Soni, A. S. New York; Columbia Univ. (1974). vp. Phys. Rev., Apr 1974.

Thesis (Ph. D.).

Reactions of the type, nu(anti nu)N yields L^{+-} + "anything", L^{+-} yields nu(anti nu) + l^{+-} + nu^{-+}/sub l/, and l^{+-} N yields L^0(anti L^0) + "anything", anti L^0 yields l^{+-} + l'^{-+} + nu/sub l'^{+-}/ where L is a lepton heavier than the muon are examined; expressions for the inclusive cross sections of the outgoing charged leptons are derived. The phase space integration is simplified by neglecting the electron and muon masses, and the differential cross section, with respect to the transverse momentum of the charged leptons in the final state, are calculated. Using a simple parameterization for the hadronic structure functions, results are presented for several incident lepton energies, between 50 and 500 GeV in the lab frame, and, for heavy lepton masses ranging from 2 to 11 GeV, assuming the coupling constant of the heavy lepton to be identical to that of the muon. A simple relation between the differential cross section of the outgoing charged leptons along the beam axis and the total cross section is obtained. Throughout these calculations the effects produced on the spectrum of the final charged lepton by the polarization of the heavy lepton are fully incorporated. A similar calculation neglecting the polarization of the heavy lepton is done and the effects due to polarization estimated. An estimation of effects due to production and decay of virtual heavy leptons and due to exchange of intermediate vector bosons is also given. (Diss. Abstr. Int., B)

2005 REGENERATION PHASE OF KAONS IN CARBON AND ARG(eta/sub +-/). Sticker, H. Irvington-on-Hudson, NY; Columbia Univ. (1974). vp. Columbia Univ., Physics Dept., Irvington-on-Hudson, NY.

Thesis (Ph. D.).

The phase of the regeneration amplitude i(f-anti f)/p at an average momentum of 7.5 GeV/c was extracted from the time dependence of the leptonic charge asymmetry of K yields pi e nu following a carbon regenerator. The value obtained, phi/sub f/ equals -40.4 +- 3.1°, includes a measured correction for incoherent regeneration. Combining with phi/sub f/determined from K yields pi mu nu and the phase difference phi/sub f/ - phi/sub +-/ from K yields pi^+pi^- yields the CP violating phase phi/sub +-/ equals arg(eta/sub +-/) equals 47.3 +- 2.7°. A comparison of the 2 pi rate and the K/sub e_3/ asymmetry provides the factor chi equals 1 - parallel x parallel ^{2}/parallel 1 + x parallel ^{2} equals 0.952 +- 0.023, where x is the ratio of DELTA S equals DELTA Q violating to conserving amplitudes. (Diss. Abstr. Int., B)

2006 EFFECTIVE RANGE EXPANSION FOR ELECTRON-NEUTRINO AND ELECTRON-ANTINEUTRINO SCATTERING. II. Kramer, G. (Univ., Hamburg). Fortschr. Phys.; 22: No. 11, 633-655(1974).

Weak interactions from a pure S-matrix point of view are considered in order to get an idea about the high energy behavior. To have the weak interaction as undisturbed as possible by electromagnetic and strong interactions one studies only the leptonic processes $e\nu \to \nu e$, $e\bar{\nu} \to \bar{\nu}e$ and $e\bar{e} \to \bar{\nu}\nu$. One calculates the corresponding partial wave amplitudes for s and p waves and constrain them by low energy behavior coming from the lowest order approximation, analyticity and unitarity. Several examples of partial wave cross sections for the three reactions with resonant behavior in the $e\nu$ or $e\bar{\nu}$ channel are calculated numerically. (auth)

Strong (General)

Refer also to abstract 1979.

2007 (JINR-E2-8908) HADRONIC CURRENTS IN THE INFINITE MOMENTUM FRAME. Toth, K. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 30p. Dep. NTIS (US Sales Only) $5.00.

The problem of the transformation properties of hadronic currents in the infinite momentum frame is investigated. A general method is proposed to deal with the problem which is based upon the concept of group contraction. The two-dimensional aspects of the IMF description are studied in detail, and the current matrix elements of a three-dimensional Poincaré covariant theory are reduced to those of a two-dimensional one. It is explicitly shown that the covariance group of the two-dimensional theory may either be a "non relativistic" (Galilei) group, or a "relativistic" (Poincare) one depending on the value of a parameter reminiscent of the light velocity in the three-dimensional theory. The value of this parameter cannot be determined by kinematical arguments. These results offer a natural generalization of models which assume Galilean symmetry in the infinite momentum frame. (auth)

2008 PHENOMENOLOGICAL MODEL OF HIGH-ENERGY HADRON-HADRON SCATTERING. St. Amand, J. Chestnut Hill, MA; Boston Coll. (1975). 171p. University Microfilms Order No. 75-15,745.

Thesis (Ph. D.).

The strong interaction of hadrons in the momentum range 10 to 400 GeV/c is investigated from the perspective of a phenomenological model of hadrons defined essentially by six axioms. Hadrons are regarded as extended objects with well defined root-mean-square radii for the strong interaction. Employing a special case of the uncertainty principle, the rms value of the transverse momentum (DELTA p/sub perpendicular to/) of the final state particles in the reaction "X + p yields anything" is calculated as a function of the maximum multiplicity observed at a given energy. Here X can be a proton, pion, or kaon. In the determination of DELTA p/sub perpendicular to/ as an implicit function of energy, the interaction probabilities of the colliding hadrons are folded geometrically to yield a probability density overlap function, W (b), which function is dependent on the impact parameter "b" and the rms interaction radii of the interacting hadrons. (JFP)

2009 ESTIMATES OF CLUSTER SIZE IN HIGH-ENERGY HADRON COLLISIONS. Ludlam, T. (Physics Department, Yale University, New Haven, Connecticut 06520); Slansky, R. Phys. Rev. D 12: No. 1, 59-64 (1 July 1975).

We discuss the parameterization of the strength of clustering effects in hadronic final states in terms of an average cluster size which is inferred from predictions of a cluster emission model. Particular attention is paid to the general question of sensitivity and the importance of assumptions regarding the kinematic constraints and statistical independence. Evidence that the cluster sizes are significantly larger than the decay multiplicities of the familiar low-mass resonances is found in a large range of experimental data. (auth)

2010 TIME ORDERING OF HIGH-ENERGY MULTIPARTICLE PRODUCTION. Goldhaber, A.S. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). Phys. Rev. Lett. 35: No. 11, 748-749 (15 Sept 1975).

For a wide class of models of high-energy collisions, the order of appearance of produced particles would be different for observers moving with different velocities. The order is simple, striking, and consistent with special relativity: The slower a particle with respect to a given observer, the earlier it appears to that observer. (auth)

2011 BASIC PREDICTIONS OF PARTON AND MULTIPERIPHERAL MODELS FOR PROCESSES WITH PRODUCTION OF PARTICLES WITH LARGE TRANSVERSAL MOMENTA. Levin, E. M.; Ryskin, M. G. (Leningrad Inst. of Nuclear Physics). Yadern. Fiz.; 21: No. 5, 1072-1083(May 1975). (In Russian)

The purpose of the work is to compare predictions of the multiperipheral model and of the parton model for productions of particles with large transversal momenta. It is shown that these two approaches provide different predictions concerning the dependence of the inclusive cross sections (f) on the initial energy and for the relative yields of various particles. Main corrections to both models are also discussed and the information is considered on the two-particle (parton) interaction that may be obtained from the dependence of the inclusive cross sections on s, q_t and rapidity and from the rapidity correlations of two particles with large q_t. (12 figures) (auth)

2012 ONE-BODY DISTRIBUTION IN THE OPTICAL MODEL. Savrin, V. I.; Semenov, S. V.; Tyurin, N. E.; Khrustalev, O. A. (Inst. of High Physics Energy, Serpukhov, USSR). Yadern. Fiz.; 21: No. 5, 1089-1092(May 1975). (In Russian)

The relation is found between the inclusive transverse momentum distribution of a final particle and characteristics of elastic scattering of colliding hadrons. (auth)

Strong (Baryon No. = 0)

2013 (ITP-75-64E) COMPLEX b-PLANE POLES. Enkovskii, L. L.; Vail, A. N. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A quantized impact parameter formalism is suggested. The impact parameter amplitude is defined as the set of coefficients in a series decomposition of the scattering amplitude T(s,t) over a system of Bessel functions orthonormalized in a finite interval. By using the Sommerfeld-Watson transform one goes to the complex b-plane. The physical content of a b-plane pole is studied. It is shown that the real part of a b-plane pole trajectory $Reb_0(s) = R$ corresponds to the resonance formation radius. A relation between the spin J mass and the radius R is derived: $J = -3/4 + R/\pi\sqrt{s-4\mu^2}$. Comparison with experimental data on $\pi\pi$ -scattering shows peripherality in the resonance formation with a universal radius $R = 1/\mu\pi$. (auth)

2014 (JINR-P2-8966) UNIFORMIZATION OF THE FORWARD SCATTERING AMPLITUDE AT HIGH ENERGIES. Gerdt, V. P.; Inozemtsev, V. I.; Meshcheryakov, V. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

An assumption is made that the amplitude of elastic hadron-hadron forward scattering, as a function of energy ν in l.c.s., is uniformized by the variable $w(\nu) = (1/\pi)\arcsin\nu$. As a consequence of this assumption there was obtained a representation of the scattering amplitude in the form of convergent series. The representation describes well the available experimental data for the processes of pp-, $\bar{p}p$-, $\pi^{\pm}p$- and $k^{\pm}p$-scattering at $\nu \geq 10$ GeV. The values σ_{tot} and a = ReF/ImF are predicted up to the energies of $\sim 10^3$ GeV. (auth)

2015 I. PHOTON TRANSITION AMPLITUDES PREDICTED BY THE TRANSFORMATION BETWEEN CURRENT AND CONSTITUENT QUARKS. II. SATURATION OF THE DRELL-HEARN-GERASIMOV SUM RULE. Karliner, I. Stanford, CA; Stanford Univ. (1975). vp. SLAC-PUB-1382; Phys. Rev. D7, 2717.

Thesis (Ph. D.).

The SU(6)-W group structure appears in both current algebra and in the spectroscopy of hadrons. Recently, a considerable progress has taken place in relating these two SU(6)-W structures. The consequences of the proposed correspondence, as it applies to real photon transitions, are investigated in this work. The general structure of such transitions is shown, and a set of resulting selection rules is presented for the multipole character of the photon amplitudes. Many specific amplitudes for both mesons and baryons are worked out and their signs and magnitudes are compared with available experimental data. The saturation of the Drell-Hearn-Gerasimov sum rule for the forward spin-flip amplitude of nucleon Compton scattering was investigated. The sum rule saturation was studied using recent analyses of single pion photoproduction in the region up to photon laboratory energies of 1.2 GeV. The original sum rule is decomposed into separate sum rules originating from different isospin components of the electromagnetic current. All three sum rules receive important nonresonant, as well as resonant, contributions. The isovector-isovector sum rule, whose contributions are known best, is found to be nearly saturated, lending support to the assumptions underlying the sum rules. The failure of the isovector-isoscalar sum rule to be saturated is then presumably to be blamed on inadequate data for inelastic contributions. (Diss. Abstr. Int., B)

2016 GENERAL NONLINEAR SU(2) x SU(2) INVARIANT MESON-NUCLEON LAGRANGIANS. Ebrahim, A. New Haven; Yale Univ. (1972). 133p. University Microfilms Order No. 75-14,404.

Thesis (Ph. D.).

The general nonlinear chiral $SU_2 \times SU_2$ invariant pion-nucleon Lagrangian proposed by Gursey is studied further in order to describe additional mesons within the chiral $SU_2 \times SU_2$ symmetry scheme. A nonlinear chiral $SU_2 \times SU_2$ invariant Lagrangian for a system consisting of the nucleon and the pi, rho, epsilon, and A_1 mesons is developed. In the development, certain vector and axial vector pion functions are introduced that are related to the usual vector and axial vector pion currents, but that transform simply under the chiral $SU_2 \times SU_2$ group. Also the usual Yang-Mills principle of local gauge invariance is generalized to invariance under Q-number chiral gauge transformations that depend on the pion field. This Q-number generalization of the Yang-Mills principle allows all the mesons except the pion to be massive in the exact chiral $SU_2 \times SU_2$ symmetry limit. The formulation of the chiral invariant pion-nucleon Lagrangian in terms of the vector and the axial vector pion functions leads naturally to a description of representation mixing in the framework of the $SU_2 \times SU_2$ invariant effective Lagrangian. Thus the representation mixing scheme for the pi, rho, epsilon, and A_1 mesons proposed earlier by Gilman and Harari emerges in this framework in a simple way. From the invariant meson-nucleon Lagrangian and the representation mixing scheme, one obtains relations between meson masses and meson coupling constants that are in satisfactory agreement with experiment. (Diss. Abstr. Int., B)

2017 RESONANCE CONTRIBUTION TO ELECTROMAGNETIC STRUCTURE FUNCTIONS. Bowling, A. L. Jr. Urbana, IL; Univ. of Illinois (1974). 121p. University Microfilms Order No. 75-011,787.

Thesis (Ph. D.).

The part of the pion and proton electromagnetic structure functions due to direct channel resonances in the virtual Compton amplitude is discussed. After a phenomenological discussion, based on the work of Bloom and Gilman, of resonance production in inelastic electroproduction, the single resonance contribution to the pion and proton structure functions is expressed in terms of transition form factors. Froissart-Gribov representations of the Compton amplitude partial waves are presented and are used to specify the spin dependence of the transition form factors. The de-

pendence of the form factors on momentum transfer and resonance mass is assumed on the basis of the behavior of exclusive resonance electroproduction. The single resonance contributions are summed in the Bjorken limit, and the result exhibits Bjorken scaling. Transverse photons are found to dominate in the Bjorken limit, and the threshold behavior of the resonant part of the structure functions is related to the asymptotic behavior of exclusive form factors at large momentum transfer. The resonant parts of the annihilation structure functions are not in general given by simple analytic continuation in the scaling variable omega' of the electroproduction structure functions. (Diss. Abstr. Int., B)

Strong (Baryon No. = 1)

Refer also to abstract 1937.

2018 (JINR–E2-8866) ISOSPIN CONSTRAINTS ON EXPERIMENTAL OBSERVABLES OF ($0\ \frac{1}{2} \rightarrow 0'0'\ \frac{1}{2}'$) REACTIONS. Ion, D. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 24p. Dep. NTIS (US Sales Only) $4.25.

The constraints on the experimental observables of three ($0\ \frac{1}{2} \rightarrow 0'0'\ \frac{1}{2}'$) reactions related by the isospin invariance were investigated. These results are useful to obtain certain tests of the isospin invariance [SU(3) -symmetry, quark models, etc.] and to discuss Pomeranchuk-like theorems in the three-body final-state reactions. (auth)

2019 (JINR–P2-8933) SEMI-INCLUSIVE PROCESSES WITH STRANGE PARTICLES. Dushutin, N. K.; Mal'tsev, V. M.; Sinegovskii, S. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The semi-inclusive processes with strange particles are considered. The distributions over multiplicity and the quantities for the semi-inclusive processes connected with them are discussed. (auth)

2020 (RL-75-107) K-p ELASTIC SCATTERING BETWEEN 1.73 GeV/c AND 2.47 GeV/c. Barber, P. C.; Broome, T. A.; Duff, B. G. (Science Research Council, Chilton (UK). Rutherford Lab.). 1975. 38p. Dep. NTIS (US Sales Only) $5.00.

Differential cross sections for the elastic scattering of negative kaons on protons are presented for 19 momenta between 1.732 GeV/c and 2.466 GeV/c. The general features of the cross sections are discussed. (5 tables, 24 figures) (auth)

2021 UNITARY STATES FOR THREE PIONS. Ascoli, G.; Wyld, H.W. (Department of Physics, University of Illinois, Urbana, Illinois 61801). Phys. Rev. D 12: No. 1, 43-58 (1 July 1975).

Recent angular momentum analyses of the three-pion system produced in the reaction $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$ have been criticized because the three-pion states used in the analysis do not satisfy unitarity. In order to answer this criticism we develop a set of unitarity equations which can be solved to yield a set of three-pion states which explicitly satisfy both three-particle unitarity and two-particle unitarity (Watson's theorem). A numerical method for solving the equations is given. When the unitary states are used to reanalyze the data for the reaction $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$ we find some changes in the detailed numerical fits but no change in the general conclusions. In particular, the phase of the amplitude for the A_1 state varies only slightly in the A_1 mass region, in contrast with the behavior expected for a resonant state. (auth)

2022 OBSERVATION OF THE EFFECT OF CROSS SECTION SIMILARITY IN $\pi^- p$ (*d*) COLLISIONS WITH MAXIMUM MOMENTUM TRANSFER TO THE TARGET PARTICLE. Abramov, B.M.; Dukhovskoĭ, I.A.; Kishkurno, V.V.; Krutenkova, A.P.; Kulikov, V.V.; Radkevich, I.A.; Tomashchuk, Yu.F.; Fedorets, V.S. (Institute of Theoretical and Experimental Physics). JETP Lett. 21: No. 9, 261-263 (5 May 1975).

The behavior of different cross sections in $\pi^- p$ (*d*) collisions with maximum momentum transfer is compared in the momentum interval 1.6–16 GeV/c. It is shown that the ratio of the partial cross sections is on the average independent of the energy, and the effect of cross-section similarity appears in the behavior of the cross sections themselves. (auth)

2023 PHENOMENOLOGICAL CORRECTIONS IN STRONG INTERACTIONS OF HADRONS. Lee, P. Toronto; Univ. of Toronto (1973). vp. National Library of Canada at Ottawa.

Thesis (Ph.D.).

Predictions and some current concepts of duality are investigated in two perspectives. The absence of the dip in backward π^+ photoproduction is examined with both the "duality" and the "$I = \frac{3}{2}$ dominance" points of view. For the amplitudes uniform combination of beta functions are employed using no arbitrary satellite terms but including parity doublets of the N_α, N_γ and Δ_δ. A rather simple explanation of the dip absence is given in terms of relative comparison of coupling constants. The solution favors the "$I = \frac{3}{2}$ dominance" view. The rigidity of the "two component duality" idea is examined. Evidences of non-Pomeron backgrounds are pointed out in πN and KN scattering. Modifications for the idea are suggested. (Diss. Abstr. Int., B)

2024 REGGE PHENOMENOLOGY AND INCLUSIVE REACTION $\pi^- p \rightarrow \pi^\pm X$ AT 40 GeV/c. Grishin, V. G.; Yuldashev, B. S. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 5, 1084-1088(May 1975). (In Russian)

It is shown that the experimental distributions of structure functions for the fragmentations $p \xrightarrow{\sim} \pi^\pm$ at 40 GeV/c are satisfactorily described by the relations derived using the factorization of Regge residues and the exchange degeneration of mesonic trajectories in exotic channels. (3 figures) (auth)

Strong (Baryon No. ≥ 2)

Refer also to abstract 2045.

2025 (JINR–E2-8956) LARGE TRANSVERSE MOMENTA AS EVIDENCE OF HIGH TEMPERATURES. Gorenstein, M. I.; Shelest, V. P.; Zinov'ev, G. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. Dep. NTIS (US Sales Only) $4.00.

In the framework of the hydrodynamical model of multiparticle production a qualitative and quantitative description is given for main regularities of the behavior of large transverse momenta secondaries with taking into account the evaporation mechanism of particles. The appearance of such particles in this model is due to large initial temperatures. (auth)

2026 UNIFIED MODEL OF HIGH ENERGY HADRONIC SCATTERING. Kirby, B. J. Providence, Brown Univ. (1974). 128p. University Microfilms Order No. 75-9192.

Thesis (Ph. D.).

The soft neutral vector meson exchange model is presented as a fundamental theory capable of explaining very high energy hadronic scattering at all angles. The model calculation lends itself to two natural approximation schemes, leading to amplitudes for near forward and wide-angle scattering respectively. In particular, the familiar eikonal amplitude describing scattering at small angles is extended to include radiative corrections to the hadron lines; and a construction is suggested in which external, multiplicative form factors and internal, Chou–Yang type form factor dependence appear simultaneously. For wide-angle scattering, previous successful fits to proton form factor and proton-proton elastic scattering data are generalized to make predictions for other elastic and quasi-elastic scattering processes. (auth)

2027 GEOMETRIC PICTURE IN HIGH ENERGY COLLISIONS. Chao, A. W. Stony Brook, NY; State Univ. of New York (1974). 135p. University Microfilms Order No. 75-5171.

Thesis (Ph. D.).

Some aspects of the geometric picture in high energy collisions, both elastic and inelastic, are studied. The Glauber-Goldhaber-Joachain model is applied to elastic proton-uranium scatterings with deformation of the uranium nucleus taken into account. It is shown unambiguously that the observed blurring of the proton-uranium differential cross section can not be due to the deformation effect alone. At the first diffraction minimum, multiple Coulomb scattering dominates the blurring. At the second minimum, the deformation effect becomes comparable to the multiple Coulomb scattering effect, but those effects are diluted by a large quasielectric background. The uranium deformation found (with large uncertainty) is consistent with earlier values. The Chou-Yang model is used to extract from recent elastic pp data information about the matter distribution inside a proton. An opacity function is defined. Its behavior as a function of impact parameter and energy is studied. Assuming the eikonal picture, real and positive opacity, one defines two parameters X and Y. The allowed region in the X–Y plane is then studied. For inelastic violent collisions, one proposes a statistical model of charge distribution among produced hadrons. This model is then applied to pp collisions. The expected numbers of various particles and their fluctuations are evaluated. The physical limitations, as well as the question of how to test this model experimentally are discussed. (Diss. Abstr. Int., B)

2028 PARITY VIOLATION IN THE NUCLEON–NUCLEON INTERACTION. Pirner, H. J. K. Stony Brook, NY; State Univ. of New York (1974). 103p. University Microfilms Order No. 75-4572.

Thesis (Ph. D.).

On the basis of a more detailed interpretation of weak strangeness changing hadronic decays, weak parity violating (p,v.) nucleon-nucleon potentials were reconstructed from the exchange of vector mesons. The naive factorization of the Cabbibo Hamil-

tonian only allows a weak p.v. coupling of charged rho mesons to the nucleons. Three models are proposed which lead to a p.v. force mediated by charged and neutral vector mesons. Besides the ad hoc hypothesis of octet dominance, two quark models, are considered which give a dynamical explanation of the DELTA I equals $^1/_2$ rule in strangeness changing hyperon decays. In one case the quarks are treated as bose particles, in the other as fermions with an extra degree of freedom (color). The bose model leads to a pure isoscalar p.v. nucleon-nucleon interaction, whereas the color Fermi quark model generates a p.v. weak isoscalar and isotensor potential. The weak N anti N rho^0 coupling is also derived from a SU(2) x U(1) gauge theory with neutral currents. (JFP)

2029 WHAT DO RAPIDITY GAPS SAY ABOUT CLUSTERING? Ludlam, T. (Physics Department, Yale University, New Haven, Connecticut 06520); Slansky, R. Phys. Rev. D 12: No. 1, 65-70 (1 July 1975).

The sensitivity of the rapidity-gap-length distribution to the degree of clustering among the secondaries in hadronic final states is investigated in several models. It is concluded that, without further theoretical assumptions, an adequate account of the data can be obtained from a wide range of models. The analysis of rapidity gaps in exclusive channels is also discussed. (auth)

2030 SCALING, LARGE-P_T DISTRIBUTION, AND FIREBALL MOTION. Hoang, T.F. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. D 12: No. 1, 296-301 (1 July 1975).

Fireball properties have been investigated using results of previous analyses of inclusive *p-p* data in terms of a Bose-type distribution modified by a scaling parameter. A discussion is presented on the relation between the scaling parameter and the longitudinal velocity of the fireball. It is found that the transverse motion may account for large-P_T distributions at 90° c.m. angle and that this motion is not detectable for $P_T < 1.5$ GeV/*c*. The fireball mass is found to increase as $(\gamma_{c.m.}-1)^{1/2}$, $\gamma_{c.m.}$ being the Lorentz transformation factor from lab to c.m. system. (auth)

2031 DIPOLE-POMERON MODEL IN PROTON-PROTON INCLUSIVE AND EXCLUSIVE PROCESSES. Antoniou, N.G.; Kouris, C.B.; Papaioannou, G.M. (Nuclear Research Center "Demokritos," Aghia Paraskevi Attikis, Greece); Manesis, E.K. Phys. Rev. D 12: No. 1, 36-42 (1 July 1975).

A model with a simple role and a double pole for the inclusive Pomeranchuk singularity has been considered. The factorization of this singularity together with the weak-coupling approximation leads to a two-component mechanism for the production processes. Self-consistency of the dipole Pomeron leads to intercept one for this singularity and a meson trajectory is generated in the exclusive process. Phenomenological implications of the model concerning multiplicity distributions and rapidity two-particle exclusive distributions are examined and a comparison with data is made. (auth)

2032 SEPARABLE LAMBDA N POTENTIALS WITH THE EFFECTS OF SIGMA-CHANNEL SUPPRESSION. Hooyman, P. J. Laramie, WY; Univ. of Wyoming (1974). 83p. University Microfilms Order No. 75-12,835.

Thesis (Ph. D.).

An attempt is made to use various two-channel YN potentials with a nonlocal separable (NLS) form in each potential's four matrix elements to represent the low energy s-wave LAMBDA N interaction. Each potential is required to reproduce the most recent scattering lengths and effective ranges of Brown, Downs and Iddings (BDI2) and to produce no resonance below the SIGMA-channel threshold. This is attempted for both spin states. Eight different forms for both NLS shapes are used in the potential first introduced by Schick and Toepfer. A resonance is found to always be present and the changes necessary in the BDI2 scattering lengths and effective ranges are investigated. The shape dependence of the LAMBDA p phase shifts produced by this model is investigated and found to be important for energies greater than 30 MeV. With Yamaguchi forms for all NLS shapes, more complicated potentials are determined for both spin states. When cross-channel suppression is utilized, several potentials for both spin states are found which reproduce the BDI2 scattering lengths and effective ranges and which have no resonance below the SIGMA-channel threshold. When both cross-channel and SIGMA-channel suppression were utilized, none of the potentials tried reproduced $^3S_1$ BDI2 results, and the $^1S_0$ BDI2 results were very closely reproduced with several potentials using V/sub SIGMA SIGMA/ equals 0. (Diss. Abstr. Int., B)

2033 QUASI-TWO-PARTICLE REACTIONS IN PROTON-PROTON INTERACTIONS AT 19.1 GeV/c MOMENTUM. Takibaev, Zh. S.; Boos, E. G.; Sanko, L. A.; Zaitsev, K. G. (Inst. of High Energy Physics, Serpukhov, USSR). Yadern. Fiz.; 21: No. 5, 1015-1021(May 1975). (In Russian)

A new method to determine the cross sections of the quasi-two-particle processes in the reactions pp → pp$\pi^+\pi^-$, pp → pp$\pi^+\pi^-\pi^0$, pp → pn$\pi^+\pi^+\pi^-$ is considered. The four-momentum differential distributions as well as the distributions in other kinematic characteristics of quasi-two-particle processes are analysed. (5 figures, 1 table) (auth)

2034 DETERMINATION OF DEGREE OF VIOLATION OF THE $\Delta T = ^1/_2$ RULE AND ESTIMATION OF THE PION–PION SCATTERING LENGTHS FROM K → 3π DATA. Bunyatov, S. A.; Volkovitskii, P. E.; Gulkanyan, G. R. (Joint Inst. for Nuclear Physics, Dubna, USSR). Yadern. Fiz.; 21: No. 5, 1055-1061 (May 1975). (In Russian)

The K → 3π experimental data have been analysed in the framework of the semiphenomenological theory of production of three strongly interacting particles near threshold. The contribution from the transition $\Delta T = ^3/_2$ to the amplitudes, partial widths and π meson spectra of various channels of K → 3π decay is determined. The possible values of the s wave $\pi\pi$ scattering lengths a_0 and a_2 in the T = 0 and T = 2 isotopic states are found. (2 figures, 2 tables) (auth)

2035 PRODUCTION OF W^+W^- PAIRS IN PROTON COLLISIONS. Vasylev, A. M.; Serbo, V. G. (Novosibirsk State Univ., USSR). Yadern. Fiz.; 21: No. 5, 1068-1071(May 1975). (In Russian)

The cross section σ_1 of the reaction pp → W^+W^- + ... is obtained in the parton model with the renormalizable Weinberg-type interaction for the transition parton + antiparton → W^+W^-. The cross section σ_1 depends on a free parameter. For the energies of the ISABELLE project ($s \sim 10^5$ GeV^2), $\sigma_1 \sim 10^{-37}$ cm^2 at M_W = 68 GeV. The cross section of the two-photon W^+W^--pair production is also obtained that may be used as a reliable lower estimate for the W^+W^--pair production cross section in the pp collisions. (2 tables, 3 figures) (auth)

Particle Invariance Principles and Symmetries

General

2036 A NON-LIE ALGEBRAIC FRAMEWORK AND ITS POSSIBLE MERITS FOR SYMMETRY DESCRIPTIONS. Ktorides, C.N. (International Centre for Theoretical Physics, Trieste, Italy). J. Math. Phys. (N.Y.) 16: No. 10, 2130-2141 (Oct 1975).

A nonassociative algebraic construction is introduced which bears a relation to a Lie algebra *L* paralleling the relation between an associative enveloping algebra and *L*. The key ingredient of this algebraic construction is the presence of two parameters which relate it to the enveloping algebra of *L*. The analog of the Poincaré–Birkhoff–Witt theorem is proved for the new algebra. Possibilities of physical relevance are also considered. It is noted that, if fully developed, the mathematical framework suggested by this new algebra should be non-Lie. Subsequently, a certain scheme resulting from specific considerations connected with this (non-Lie) algebraic structure is found to bear striking resemblance to a recent phenomenological theory proposed for explaining CP violation by the K^0 system. Some relevant speculations are also made in view of certain recent trends of thought in elementary particle physics. Finally, in an appendix, a Gell-Mann–Okubo-like mass formula for the new algebra is derived for an *SU* (3) octet. (auth)

2037 SU(4) AND SU(8) MASS SPLITTING AND THE POSSIBLE EXISTENCE OF NEW HADRONS. Moffat, J.W. (Department of Physics, University of Toronto, Toronto, Ontario M5S 1A7, Canada). Phys. Rev. D 12: No. 1, 288-290 (1 July 1975).

A mass formula for SU(4) and SU(8) is compared with predicted charmed meson and baryon masses. Comments are made about the spectroscopy of SU(4) quark models and the significance of ψ and ψ' decay modes. (auth)

2038 SU(5) SYMMETRY. Krasnikov, N.V.; Kuz'min, V.A. (Nuclear Research Institute, USSR Academy of Sciences). JETP Lett. 21: No. 8, 235-236 (20 Apr 1975).

It is suggested that the recently discovered particles ψ_1(3105) and ψ_2(3695) are members of a 25-plet of vector mesons within the framework of the SU(5) groups. The masses of the 1^- and 0^- mesons in the lowest multiplets of the SU(5) group are calculated. (auth)

2039 NEW NARROW BOSON RESONANCES AND SU(4) SYMMETRY: SELECTION RULES, SU(4) MIXING, AND MASS FORMULAS. Takasugi, E.; Oneda, S. (Center for Theoretical Physics, Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). Phys. Rev. D 12: No. 1, 198-205 (1 July 1975).

General SU(4) sum rules are obtained for bosons in the theoretical framework of asymptotic SU(4), chiral SU(4) ⊗ SU(4) charge algebra, and a simple mechanism of SU(4) and chiral SU(4) ⊗SU(4) breaking.

The sum rules exhibit a remarkable interplay of the masses, SU(4) mixing angles, and axial-vector matrix elements of 16-plet boson multiplets. Under a particular circumstance (i.e., in the "ideal" limit) this interplay produces selection rules which may explain the remarkable stability of the newly found narrow boson resonances. General SU(4) mass formulas and inter-SU(4) -multiplet mass relations are derived and SU(4) mixing parameters are completely determined. Ground state 1^{--} and 0^{-+} 16-plets are especially discussed and the masses of charmed and uncharmed new members of these multiplets are predicted. (auth)

Applications (Electromagnetic and Weak)

Refer also to abstract 1832.

2040 CONCERNING THE POSSIBILITY OF VERIFYING SU(3) —SYMMETRY BREAKING IN THE REACTIONS $e^+e^-\to 3\pi$ AND $e^+e^-\to\pi^0\gamma$. Achasov, N.N.; Kozhevnikov, A.A.; Shestakov, G.N. (Mathematics Institute, Siberian Division, USSR Academy of Sciences). JETP Lett. 21: No. 8, 229-230 (20 Apr 1975).

It is shown that a minimum in the cross sections of the reactions $e^+e^-\to 3\pi$ and $e^+e^-\to\rho^0\gamma$ is predicted by the "mass mixing" model past the ϕ resonance, and by the "current mixing" model ahead of the ϕ resonance. (auth)

2041 PROBLEMS WITH THE ACHIMAN MODEL IN THE DEEP-INELASTIC REGION. Razmi, M.S.K. (Institute of Theoretical Science, University of Oregon, Eugene, Oregon 97403). Phys. Rev. D 12: No. 1, 305-308 (1 July 1975).

It is pointed out that the prediction of a large charge-symmetry violation by the Achiman gauge-symmetry model also leads to a violation of the positivity condition on the structure function $F_2^{\nu N}$. A search for the origins of this inconsistency is made. (auth)

Scattering Theory

Refer also to abstract 2241.

2042 DELBRÜCK SCATTERING CALCULATIONS. Papatzacos, P.; Mork, K. (Institute of Physics, University of Trondheim, Norges Laererhøgskole, Trondheim, Norway). Phys. Rev. D 12: No. 1, 206-218 (1 July 1975).

The cross section for elastic scattering of photons on a static Coulomb potential, Delbrück scattering, is calculated in the lowest-order Born approximation. Using conventional Feynman techniques and gauge invariance we obtain expressions for the real and imaginary parts of the scattering amplitude for polarized photons. These rather complicated expressions contain multidimensional integrals which have been evaluated partly by analytical and partly by numerical methods, and Delbrück amplitudes have been obtained for various scattering angles and for photon energies ω varying from zero to several GeV. The results confirm earlier calculations at very low energies ($\omega \ll 1$ MeV), confirm the imaginary parts but disagree with the real parts previously obtained by Ehlotzky and Sheppey for $\omega < 20$ MeV, and confirm the high-energy results of Cheng and Wu to lowest order. A comparison with some recent experiments is shown. (auth)

2043 INCLUSIVE SCATTERING AT LARGE TRANSVERSE MOMENTA IN A RENORMALIZABLE THEORY. Roth, M.W. (Physics Department, University of Illinois, Urbana, Illinois 61801). Phys. Rev. D 12: No. 1, 219-236 (1 July 1975).

Inclusive scattering at large transverse momentum p_T has been studied in pseudoscalar meson theory by summing the leading logarithmic diagrams. The diagrams analyzed have a two-blob, peripheral blob, or crossed two-blob structure. Explicit low-order calculations indicate that these sets of diagrams give the leading ln$s$ contribution, where s is the center-of-mass energy squared. The main results are as follows: (1) To within logarithmic terms, order-by-order perturbation theory gives the result expected from dimensional analysis; (2) the summation of leading logarithmic diagrams gives a $p_T{}^{-4}$ power law times a function of $p_T/(s)^{1/2}$, the center-of-mass scattering angle $\theta_{c.m.}$, and the variable $\xi_s = -\ln[1-(5g^2/16\pi^2)\ln s]/5$; (3) there is a strong relation to deep-inelastic scattering and to light-cone methods; (4) in all cases the spectrum falls for large, fixed p_T and increasing energy; and (5) crossing symmetry is explicitly realized. (auth)

2044 THE EIKONAL APPROXIMATION AND E (2) INVARIANCE. Harnad, J.P. (Department of Physics, Carleton University, Ottawa). Ann. Phys. (N.Y.) 91: No. 2, 413-441 (June 1975).

A group theoretic interpretation is given for the eikonal approximation in potential scattering. This is based upon the approximate invariance at high energies under translations and rotations in the transverse scattering plane; that is, symmetry under the group E (2). The Lippman-Schwinger equation is formulated in a set of basis states which transform invariantly under irreducible representations of E (2) and the solution for the eikonal Hamiltonian, together with lowest order(Saxon-Schiff) corrections is obtained within the basis. A formulation of unitarity in the impact-parameter representation, based upon the E (2) invariance is given. The "geometrical" interpretation of this representation, in connection with the eikonal approximation, is made clear by our approach. (auth)

2045 SCATTERING CALCULATIONS IN A THREE-BOSON-MODEL WITH INTEGRAL EQUATION METHODS AND VARIATIONAL METHODS. Sohre, F. Tuebingen, Ger.; Tuebingen Univ. (1972). 76p. (In German). INIS.

Thesis.

The integral equation method according to Faddeev and the variational method are compared with each other for the three-boson-model. Furthermore, the n-D break-up reaction according to the resonating group method is dealt with, and the amplitudes for the three-particle break-up are calculated. (auth)

PHYSICS (LOW-TEMPERATURE)

Superconductivity

Refer also to abstracts 418, 1123, 1174, 1202, 1221, 1228, 1230, 1234, 1238, 1258, 1292–1294, 1296, 1297, 1306, 1307, 1313, 1315, 1323, 1327, 1333, and 1348.

2046 (AED-CONF-75-170-007) SUPERCONDUCTIVITY OF MANY PHASE SYSTEMS. Raub, C. J.; Khan, H. R. (Forschungsinstitut fuer Edelmetalle und Metallchemie, Schwaebisch Gmuend (F. R. Germany)). 1975. 5p. INIS.

From general meeting of the Deutsche Gesellschaft fuer Metallkunde; Nuernberg, F. R. Germany (20 May 1975).

10 figs.; 4 refs.

The influence of inhomogeneities on the transition temperature is described by the example of the systems Cu-Pb, $Nb_3(Al,Ge)$, and Nb_3Au. (GE)

2047 (JINR-P4-9087) ONE-DIMENSIONAL HUBBARD MODEL. Kharrasov, M. Kh. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1971. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

An analog of the Bogolyubov inequality was obtained for the case of zero temperature. It was shown that a gap in the energy spectrum of one-particle excitations in the infinite one-dimensional Hubbard model can exist only at zero temperature. (tr-auth)

2048 CONDUCTIVITY, PERMEABILITY, AND DIELECTRIC CONSTANT IN A MULTIFILAMENT SUPERCONDUCTOR. Carr, W.J., Jr. (Westinghouse Research Laboratories, Pittsburgh, Pennsylvania 15235). J. Appl. Phys. 46: No. 9, 4043-4047 (Sept 1975).

Results are given for the permeability, conductivity, and dielectric constant of a multifilament superconductor, treated as an anisotropic state of matter. The calculations are made for the limiting cases of strong and weak ac magnetic fields compared with the field required for complete penetration of the filaments. General expressions are given for the ac power loss. (auth)

2049 ALTERNATING FIELD LOSS IN A MULTIFILAMENT SUPERCONDUCTING WIRE FOR WEAK AC FIELDS SUPERPOSED ON A CONSTANT BIAS. Carr, W.J. Jr.; Walker, M.S.; Murphy, J.H. (Westinghouse Research Laboratories, Pittsburgh, Pennsylvania 15235). J. Appl. Phys. 46: No. 9, 4048-4052 (Sept 1975).

Expressions are given for the alternating field loss in a twisted filamentary superconductor as a function of frequency and magnetic field, for the case of small ac applied fields which do not completely penetrate the filaments. The ac field is superimposed on a fixed bias field. In this limit the effective diamagnetism of the filament leads to a permeability less than unity for the composite. Expressions are presented for both the hysteresis and the eddy current loss. (auth)

2050 THEORY OF THE COUPLING FORCE IN MAGNETICALLY COUPLED TYPE-II SUPERCONDUCTING FILMS Clem, J.R. (Ames Laboratory–ERDA and Department of Physics, Iowa State University, Ames, Iowa 50010). Phys. Rev. B 12: No. 5, 1742-1752 (1 Sept 1975).

A pair of infinite type-II superconducting films with thicknesses d_p and d_s and penetration depths λ_p and λ_s separated by an insulating layer of thickness d_i is assumed to contain in the primary film a triangular-vortex lattice, initially in perfect registry directly below an identical lattice in the secondary film. A theory is developed for the coupling force exerted upon a secondary vortex by the primary vortex lattice as a function of the displacement of the primary lattice relative to the secondary lattice. The theory is based upon a London model of the vortex line, modified to account for vortex-core effects. The theoretical maximum coupling force is largest at low flux density, where it has a value of order $\varphi_0^2/8\pi^2\rho_{eff}^2$, where $\varphi_0 = hc/2e$ and $\rho_{eff} = d_i + \lambda_p \coth(d_p/\lambda_p) + \lambda_s \coth(d_s/\lambda_s)$. (auth)

2051 MAGNETIC COUPLING FORCE OF THE SUPERCONDUCTING DC TRANSFORMER. Ekin, J.W. (Cryogenics Division, National Bureau of Standards-Institute for Basic Standards, Boulder, Colorado 80302); Clem, J.R. Phys. Rev. B 12: No. 5, 1753-1765 (1 Sept 1975).

The temperature dependence and magnetic field dependence of the coupling force have been measured in two transformer systems, one with primary and secondary film thicknesses d_p and d_s comparable with the superconducting penetration depth λ ($d_p/\lambda_p \sim d_s/\lambda_s \sim 1$) and one with film thicknesses small compared with the penetration depth ($d_p/\lambda_p \sim d_s/\lambda_s \sim 10^{-1}$). The results show that (i) the coupling force is nearly two orders of magnitude greater in the thick-film transformer than in the thin-film transformer; (ii) there exists a transition field above which the coupling force decreases very rapidly, typical values for the transition field being quite low (~ 0.5 G); and (iii) the temperature dependence of the coupling force over much of the range investigated is simply proportional to the temperature dependence of $\lambda_p^{-2}\lambda_s^{-2}$. A Gibbs–free-energy theory describing the coupling force has been numerically evaluated and compared with these data. The results show that the theory can be used to predict accurately both the absolute magnitude and the field and temperature dependences of the coupling force for wide-ranging values of the operating parameters. (auth)

2052 BERNOULLI POTENTIAL IN SUPERCONDUCTORS. Hong, K.M. (Department of Physics, University of Toronto, Toronto, Ontario, M5S 1A7 Canada). Phys. Rev. B 12: No. 5, 1766-1771 (1 Sept 1975).

The Bernoulli potential in a superconductor is calculated using the Gorkov equations. General expressions for the potential are derived. In the high-κ limit, the expression reduces to the result of the two-fluid model augmented by a term due to the spatial variation of the order parameter. The temperature dependence of the potential is computed, in the case of clean superconductors, for various values of κ, and, in the case of impure superconductors, for $\kappa = \infty$. (auth)

2053 OBSERVABILITY OF JOSEPHSON PAIR-QUASIPARTICLE INTERFERENCE IN SUPERCONDUCTING INTERFEROMETERS. Hansma, P.K. (Department of Physics, University of California, Santa Barbara, California 93106). Phys. Rev. B 12: No. 5, 1707-1711 (1 Sept 1975).

Pair-quasiparticle interference current has a measurable effect on the tuning characteristics of a superconducting interferometer operating in the nonhysteretic regime: $\epsilon \equiv (2\pi/\Phi_0)\, L_R I_c < 1$ where $\Phi_0 = h/2e$, L_R is the inductance of the interferometer ring, and I_c is the critical current of the interferometer's weak link. In the limit $\epsilon \ll 1$ the interferometer will have a zero crossing in its magnetic flux sensitivity versus frequency characteristic that is above, on, or below resonance depending whether the coefficient of the interference current term is positive, zero, or negative, respectively. For larger ϵ, screening currents will also shift the zero crossing. Results for the magnitude of this additional shift are presented and discussed. (auth)

2054 OBSERVATION OF A COSϕ TERM IN THE CURRENT-PHASE RELATION FOR "DAYEM"-TYPE WEAK LINK CONTAINED IN AN rf-BIASED SUPERCONDUCTING QUANTUM INTERFERENCE DEVICE. Nisenoff, M.; Wolf, S. (Naval Research Laboratory, Washington, D.C. 20375). Phys. Rev. B 12: No. 5, 1712-1714 (1 Sept 1975).

The presence of a cosϕ term in the current–quantum-mechanical phase relation for a superconducting weak link can be established from the frequency response of an rf-biased superconducting quantum interference device containing the structure. For narrow constrictions, the sign of the coefficient of the cosine term was determined to be *negative*. (auth)

2055 ALTERNATING CURRENT LOSSES IN SUPERCONDUCTING CONDUCTORS FOR LOW-FIELD APPLICATIONS. Janocko, M. A.; Deis, D. W.; Carr, W. J. Jr. (Westinghouse Research Lab., Pittsburgh). Adv. Cryog. Eng.; 19: 171-180 (1974).

A study has been made of ac loss characteristics of type-II superconductors due to hysteresis losses in the superconducting material and eddy current losses in the normal matrix in the absence of an applied field. Losses were measured for Nb_3Sn tapes, a Nb multifilament conductor, and NbTi multifilament and single-core conductors at 60 Hz and 4.2 K. The feasibility of using these materials in power transmission lines is considered. (SDF)

2056 SUPERCONDUCTIVITY IN METALS, ALLOYS, SEMICONDUCTORS: AND GLASSES AS A RESULT OF PARTICULAR CHEMICAL BOND SYSTEMS. Krebs, H. (Univ., Stuttgart). Prog. Solid State Chem.; 9: 269-296(1975).

The subject is dealt with in sections, entitled: characterization of the superconducting state; attempts at an interpretation of the superconducting state; attempt at an interpretation of superconductivity by the theory of chemical bond; NaCl-type structures; glassy superconductors; compounds with MoS_2 structure; tungsten bronzes and perovskites; compounds with CaC_2 structure; body-centered cubic structures; compounds with Nb_3Sn structure. (UK)

2057 MAGNETIZATION AND PINNING EFFECT OF A JOSEPHSON JUNCTION. Yamashita, T.; Rinderer, L. (Univ. of Lausanne, Switzerland). J. Low Temp. Phys.; 21: No. 1/2, 153-168(Oct 1975).

The magnetization and the pinning effect of a Josephson junction have been analyzed by using a mechanical analog. The influences of an applied current on the magnetization and the critical current have been studied. The peak and the training effects have

been observed when inhomogeneities are introduced into the junction. The behavior of the junction is qualitatively analogous to that of a type II superconductor. The mechanical model is a useful analog computer for studying precisely and visually the vortex behavior of the junction and is also helpful in understanding qualitatively that of a type II superconductor. (5 figures, 1 table) (auth)

2058 KINETICS OF THE DESTRUCTION OF SUPERCONDUCTIVITY BY A CURRENT IN LEAD WIRES. Posada, E.; Rinderer, L. (Univ. of Lausanne, Switzerland). J. Low Temp. Phys.; 21: No. 1/2, 27-45(Oct 1975).

An experimental investigation of the kinetics of the destruction of superconductivity by a current in cylindrical lead wires is presented. The results show that if the current is about 10 percent larger than the critical value J/sub c/ calculated from Silsbee's hypothesis, the transition is essentially governed by electromagnetic damping and is well described by the isothermal theory of Rothen and Bestgen. If the current lies between J/sub c/ and 1.1 J/sub c/, the observed transition times are much longer than those predicted by the isothermal theory. The influence of thermal effects is discussed in detail and a calculation of the transition times close to J/sub c/ is given which leads to an improved agreement with experiment. The calculations are also compared with previous experimental results on tin specimens. (10 figures, 1 table) (auth)

2059 EQUILIBRIUM MAGNETIZATION PROPERTIES OF IRREVERSIBLE SUPERCONDUCTING NIOBIUM WITH PEAK EFFECT. Kartascheff, N. (Bayerischen Akademie der Wissenschaften, Garching, Ger.). J. Low Temp. Phys.; 21: No. 1/2, 203-217(Oct 1975).

Measurements of the equilibrium magnetization curve of type II superconductors have usually only been possible on reversible specimens. In this paper, a method to measure the equilibrium magnetization curve of irreversible type II superconductors is described. Results obtained by this method from a hysteretic Nb specimen exhibiting the peak effect are reported. They show an irregularity in the shape of the equilibrium magnetization curve in the neighborhood of H/sub c2/ which corresponds to a minimum of the compressional modulus K of the flux line lattice. The minimum of K also corresponds with the maximum of the critical current density J/sub c/, which strongly suggests that in this case the peak effect is originated by a "soft point" of the flux line lattice. The observed anomaly of K is discussed in terms of a possible first-order phase transition in the flux line lattice. (auth)

PHYSICS (NUCLEAR)

For titles of individual papers see: 2084, 2085, 2095, 2148, and 2149.

2060 (AECL-5121) PHYSICS DIVISION PROGRESS REPORT, 1 JANUARY–31 MARCH 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). May 1975. 153p. (PR-P-105). Dep. NTIS (US Sales Only) $10.75. AECL $3.00.

Modifications in hardware resulting in improved MP Tandem operation are recounted. Assembly of the Fast Intense Neutron Source is continuing. Work in the Heavy-Ion Superconducting Cyclotron development program is set forth. Research activities in nuclear physics, nuclear power applications, and solid-state physics are reviewed. Investigation of puzzling temperature-dependent effects in positron annihilation in Cu seems to rule out radiation damage induced by the positron source itself as a possible cause. Developments in detector fabrication are reported. Among the activities of the mathematics and computation branch were extension of a model for simulation of the dynamic behavior of deuterium concentration in the Bruce Heavy Water Plant and the incorporation of a version of the gear integration algorithm using sparse matrix analysis into the FORSIM system for such uses as problems in neutron kinetics. Several items with significant amounts of information are listed separately by title. (14 figures, 6 tables) (RWR)

2061 (CONF-750664-(Absts.)) GENERAL SCIENTIFIC CONFERENCE OF THE BELGIAN SOCIETY OF PHYSICS, ANTWERP, JUNE 2–3, 1975. (Rijksuniversitair Centrum te Antwerpen (Belgium)). 1975. 98p. (In Several Languages). Dep. NTIS (US Sales Only) $8.00.

From general scientific conference of the Belgian Society of Physics; Antwerp, Belgium (2 Jun 1975).

Abstracts from the Belgian Physical Society meeting are given. Papers were presented on the following subjects: physics of the solid state, 39; physics of plasmas, 9; atomic and molecular physics, 10; nuclear physics, 22; elementary particle physics, 12; and astrophysics and geophysics, 5. There was also an unclassified paper on incommensurability in the solid state. Abstracts appear in Dutch, English, and French. (RWR)

2062 (DEU-75-14) PROGRESS REPORT 1971/72. (Giessen Univ. (F. R. Germany). Strahlenzentrum). 1972. 276p. (In German). INIS.

With figs.; tabs. and refs.

The progress report comprises reports from interdisciplinary task groups on radiation protection, isotope application and radiation measurement technique, microscopy, linear accelerators, process computers, biophysics and nuclear physics. The last task group reports on work with the electron linear accelerator, nuclear spectroscopy, neutron physics, work with polarized particles, and experiments with the GSI heavy ion accelerator. (auth)

2063 (LA-6030-C) ABSTRACTS OF CONTRIBUTED PAPERS. Sixth international conference on high-energy physics and nuclear structure, Santa Fe and Los Alamos, NM, June 9–14, 1975. Mischke, R.; Hargrove, C.; Hoffman, C. (comps.). (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1975. Contract W-7405-Eng-36. 401p. (CONF-750631-(Absts.)). Dep. NTIS $10.60.

From sixth international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

Abstracts of contributed papers are assembled under the following headings (number denotes the number of abstracts in the section): pi p and pi d interactions (10); pi nucleus theory (33); intermediate isobar calculations (8); pi-nucleus interactions (25); stopping muons (44); exotic atoms and condensed nuclear states (28); nucleus-nucleus interactions (31); nuclear structure and hypernuclei (7); nucleon-nucleon interactions (24); e- and gamma-nucleus interactions (29); weak interactions (17); high energy collisions (13); heavy ions (22); instrumentation (8). (SDF)

2064 (PB–238508) REPORT OF NRL PROGRESS. (Naval Research Lab., Washington, D.C. (USA)). Sep 1974. 51p. NTIS $4.25.

Contents include underwater sound; acoustics, laser interferometry; voice communications, radar, metallurgy, glass fracture, nuclear physics, solid state physics, and patents. (GRA)

2065 NUCLEAR AND PARTICLE PHYSICS. A. Background and Symmetries. Frauenfelder, H.; Henley, E. M. Lecture Notes and Supplements in Physics, No. 14. Reading, MA; W. A. Benjamin, Inc. (1975). 590p. $21.50.

The topics covered include an historical survey, classical concepts and conservation laws, particles, antiparticles, and fields, nonclassical conservation laws, and superposition and interference. (JFP)

Neutron Interactions with Matter

Refer also to abstracts 2151 and 2166.

2066 (AAEC/E–360) EIGENVALUES OF THE DISCRETE ORDINATES EQUATIONS IN SLAB GEOMETRY. Donnelly, I. J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Sep 1975. 23p. Dep. NTIS (US Sales Only) $4.25.

The discrete ordinates approximation of the one-group, source-free, neutron transport equation has been solved analytically for slab geometry. The resulting eigenvalues are functions of both the angular quadrature and the spatial mesh used in the discrete ordinates equations. The dependence of the eigenvalues on the angular quadrature has been examined for the three limiting cases of $c \ll 1$, $|1-c| \ll 1$ and $c \ll 1$, where $c = \sigma_s/\sigma_t$. Both the diamond difference and step function approximations have been considered in the evaluation of the eigenvalue dependence on the spatial mesh size. (auth)

2067 (INIS-mf-1698, pp 264-278) AQUEOUS AND HYDRIDE–ZIRCONIUM CONVERTERS OF ULTRACOLD NEUTRONS. Neutron Confinement in Copper and Glass Vessels. Groshev, L. V.; Dvoretskii, V. N.; Demidov, A. I.; Lushchikov, V. I.; Nikolaev, S. A.; Panin, Yu. N.; Pokotilovskii, Yu. N.; Strelkov, A. V.; Shapiro, F. L. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

This study presents the results of experiments in retaining ultracold neutrons in vessels made of copper and glass. Emphasis is placed on the possibility of the existence of a supplemental mechanism for the absorption of ultracold neutrons in the vessel walls, which is different from the generally accepted mechanism of absorption. A description is also given of a proportional, He-3 counter having a greater efficiency than the usual scintillation detector. A description is presented of a neutron guide with an aqueous convertor of ultracold neutrons. (tr-SJR)

2068 (JINR–P4-9007) INFLUENCE OF THE SPECULAR REFLECTION ON THE STORAGE TIME OF ULTRACOLD NEUTRONS IN CLOSED VESSELS. Ignatovich, V. K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1975. 19p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

It is shown that the storage time of ultracold neutrons is expressed identically in terms of the mean value of the absorption coefficient in all the cases when the part of nonspecular reflection exceeds considerably the absorption at a single collision with the wall. (auth)

2069 (KFK-2200, pp 1-23) INTERACTION OF SLOW NEUTRONS WITH BOUND MATTER. Beckurts, K. H.; Glaeser, W. Apr 1975. (In German).

In contributions to nuclear engineering.

A report on the determination of neutron temperature and neutron spectra in graphite, on the further development of the time-of-flight methods and their application to the study of solid-state properties such as lattice dynamics of superconductors and dynamics of molecular crystals. (GE)

2070 (NEANDC(E)-163U, pp 63-71) SHAPE ANALYSIS OF VARIOUS ^{232}Th AND ^{238}U TRANSMISSION DATA. Derrien, M.; Ribon, P. (CEN, Saclay, France). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

Results of independent shape analyses of ^{238}U and ^{232}Th transmission data are compared and comments are offered on their consistency. (SDF)

2071 (ORNL-TM-5023) MEASUREMENT OF SECONDARY NEUTRONS AND GAMMA RAYS PRODUCED BY NEUTRON INTERACTIONS WITH NITROGEN AND OXYGEN OVER THE INCIDENT ENERGY RANGE 1 TO 20 MeV. Morgan, G. L. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-Eng-26. 147p. Dep. NTIS $7.60.

The spectra of secondary neutrons and gamma rays produced by neutron interaction in thick samples (approximately 1 mean free path) of liquid nitrogen and liquid oxygen have been measured as a function of the incident neutron energy over the range 1 to 20 MeV. Data were taken for angles of 30^0, 55^0, 90^0, and 125^0. A linac (ORELA) was used as a neutron source with a 47-m flight path. Incident energy was determined by time-of-flight, while secondary spectra were determined by pulse-height unfolding techniques. The results of the measurements are presented in forms suitable for comparison to calculations based on the evaluated data files. (32 figures, 42 tables) (auth)

2072 (VTT-YDI-2) SYMMETRIZED PERTURBATION PROCEDURE FOR THE TRANSPORT OPERATOR. Pitkaeranta, J.; Silvennoinen, P. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Jun 1973. 15p. Dep. NTIS (US Sales Only) $4.00.

A perturbation procedure based upon a symmetrized form of the linear transport operator is introduced. Results of the analytical perturbation theory are applied in establishing the existence of perturbation series for the operator and its eigenvalues. The proposed procedure is numerically implemented in reactor mathematics where eigenvalue perturbations are computed and the results compared with the pertinent exact values. (auth)

2073 (VTT-YDI-7) ETOTO: A PROGRAM TO PROCESS DATA FROM ENDF/B TO THERMOS-OTA AND FACEL. Patrakka, E. (Valtion Teknillinin Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Sep 1973. 39p. Dep. NTIS (US Sales Only) $5.00.

Program ETOTO processes basic nuclear data in the ENDF/B format and produces the data required for the generation of the thermal libraries of THERMOS-OTA and FACEL. Since the scattering kernels are not derived from ENDF/B in THERMOS-OTA and FACEL libraries, the thermal scattering laws contained in ENDF/B are not processed by ETOTO. The processing routines of ETOTO are similar to those of program ETOF. ETOTO is written in Fortran V for the Univac 1108 computer. In addition to printed results, the output includes punched cards in the format appropriate for the generation of a THERMOS-OTA or a FACEL library. (auth)

2074 POSITIVE SOLUTION OF A TIME AND ENERGY DEPENDENT NEUTRON TRANSPORT PROBLEM. Pao, C.V. (Department of Mathematics, North Carolina State University, Raleigh, North Carolina 27607). J. Math. Phys. (N.Y.) 16: No. 10, 2166-2171 (Oct 1975).

The purpose of this paper is to give a constructive method for the determination of a solution and an existence-uniqueness theorem for some nonlinear time and energy dependent neutron transport problems, including the linear transport system. The geometry of the medium under consideration is allowed to be either bounded or unbounded which includes the geometry of a finite or infinite cylinder, a half-space and the whole space R^m ($m=1,2,\cdots$). Our approach to the problem is by successive approximation which leads to various recursion formulas for the approximations in terms of explicit integrations. It is shown under some Lipechitz conditions on the nonlinear functions, which describe the process of neutrons absorption, fission, and scattering, that the sequence of approximations converges to a unique positive solution. Since these conditions are satisfied by the linear transport equation, all the results for the nonlinear system are valid for the linear transport problem. In the general nonlinear problem, the existence of both local and global solutions are discussed, and an iterative process for the construction of the solution is given. (auth)

2075 INELASTIC NEUTRON SCATTERING FROM AMORPHOUS SOLIDS. I. CALCULATION OF THE SCATTERING LAW FOR MODEL STRUCTURES. Carpenter, J.M. (Department of Nuclear Engineering, University of Michigan, Ann Arbor, Michigan 48105; Pelizzari, C.A. Phys. Rev. B 12: No. 6, 2391-2396 (15 Sept 1975).

We present a method for calculating the one- and two-phonon law $S(Q,\omega)$ for models of amorphous solids. The calculation is considerably simplified by explicitly performing the necessary orientation averages. We illustrate use of the method by calculating the one-phonon scattering from long-wavelength acoustic waves in an amorphous solid. In the small-Q region a Brillouin scattering is predicted. (auth)

2076 INELASTIC NEUTRON SCATTERING FROM AMORPHOUS SOLIDS. II. INTERPRETATION OF MEASUREMENTS. Carpenter, J.M. (Solid State Science Division, Argonne National Laboratory, Argonne, Illinois 60439; Pelizzari, C.A. Phys. Rev. B 12: No. 6, 2397-2401 (15 Sept 1975).

The one-phonon scattering law for a disordered harmonic system is related to a frequency-dependent displacement-displacement correlation function. We suggest a means of investigating this correlation function by means of a suitable transformation of inelastic neutron scattering data for such systems. (auth)

2077 MEASUREMENT OF THE NEUTRON AND GAMMA-RAY SPECTRA ORIGINATING FROM A 14-MeV NEUTRON SOURCE IN LIQUID NITROGEN AND LIQUID AIR. Broecker, B.; Clausen, K.; Schneider-Kuehnle, P.; Weinert, M. (Inst. fuer Naturwissenschaftlish-Technische Trendanalysen, Stohl, Ger.). Nucl. Sci. Eng.; 58: No. 2, 226-238(Oct 1975).

An experiment to measure the radiation transport originating from a 14-MeV neutron source in liquid nitrogen and liquid air is presented. Neutron and gamma-ray spectra were measured with a proton-recoil NE 213 scintillator and with four spherical proportional counters in a tank filled with liquid nitrogen or liquid air. The neutron spectra cover the energy range of 20 keV to 18 MeV. The source-detector separation varies in the liquid medium between 60 and 240 cm. The experimental setup is briefly described and the errors are estimated. (2 tables, 9 figures) (auth)

Nuclear Properties and Reactions, $A \leq 5$

Refer also to abstract 2196.

2078 (INIS-mf-1698, pp 315-318) NEUTRON YIELD IN PROTON–TRITIUM INTERACTION. Kuz'min, E. A.; Sidorov, N. I.; Faiziev, A. R.; Chulkov, L. V.; Yan'kov, G. B. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Results are presented on measuring differential cross-sections of the T(p,n)He-3 reaction in the proton energy interval of 6.5 to 15.3 MeV, and also the cross-section and energy spectra of neutrons from tritium disintegration at proton energies of 11.2 to 15.3 MeV at an angle of 0°. (tr-SJR)

2079 POLARIZATION IN PROTON-PROTON SCATTERING AT 10 MeV. Hutton, J.D.; Haeberli, W. (University of Wisconsin, Madison, Wisconsin 53706); Knutson, L.D.; Signell, P. Phys. Rev. Lett. 35: No. 7, 429-432 (18 Aug 1975).

The polarization in proton-proton scattering at 10.0 MeV has been measured at seven angles with an accuracy of $\pm 2\times 10^{-4}$. Model-independent values of the phase shifts at 10 MeV are deduced from an analysis of the cross-section and polarization data. The implications for existing energy-dependent phase-shift sets are examined. (auth)

2080 QUASI-GROUND, QUASI-BETA, AND QUASI-GAMMA BANDS, 1974. Sakai, M. (Univ. of Tokyo). At. Data Nucl. Data Tables; 15: No. 6, 513-515(Jun 1975).

For even–even nuclei a list is presented of the probable members of quasi-ground, quasi-beta, and quasi-gamma bands of the spherical regions and the corresponding ground, beta, and gamma bands of the deformed regions. For simplicity the term "quasi" is used for both regions. References are given to the experimental data basic to the level assignments. The literature has been covered through November 1974. (2 figures, 1 table, extensive references) (auth)

2081 TOTAL CROSS SECTION AND ANGULAR DISTRIBUTIONS OF PHOTONEUTRONS FROM THE REACTION $^4He(\gamma,n)^3He$ AT E_γ = 27 TO 30 MeV. Arkatov, Yu. M.; Vatset, P. I.; Voloshchuk, V. I.; Gur'ev, V. N.; Zolenko, V. A.; Prokhorets, I. M.; Chmil, V. I. (Physical-Technical Inst., Kiev). Yadern. Fiz.; 21: No. 5, 925-929(May 1975). (In Russian)

Experimental values of the total cross sections and angular distributions of photoneutrons from the reaction $^4He(\gamma,n)^3He$ are obtained in the photon energy region 27–30 MeV. The angular distributions are analysed and the values of electric dipole and quadrupole cross sections and of the phase shift of E1 and E2 amplitudes are found. The results are compared with similar quantities for (γ,p)-reactions. (2 tables, 2 figures) (auth)

2082 TRITON BINDING ENERGY FOR LOCAL SQUARE WELL POTENTIAL. Purkayastha, G.; Sil, N. C. (Indian Association for the Cultivation of Science, Calcutta). Indian J. Phys.; 48: No. 10, 921-924(Oct 1974).

The applicability of a new method of approximating the two-body t matrix in separable form for the general local short-range interaction as suggested earlier was tested in the calculation of triton binding energy with Faddeev formalism. The square-well potential was considered since convergent theoretical binding energy values by Sturmian expansion method are available for this potential. By using a two-term and three-term expansion, the binding energy values of the triton were evaluated by taking the triplet plus singlet states of the deuteron. It was observed

that the binding energy values for the second case are very close to the results obtained by Kharchenko and Storozhenko for the same potential by using the Sturmian expansion method. The present method has the advantage over the Sturmian method in that it is applicable to more general short-range potentials and to higher partial waves. (1 table) (auth)

2083 INVESTIGATION OF HIGHLY EXCITED STATES IN ^{4}He IN THE ENERGY RANGE BETWEEN 20.0 AND 26.0 MeV. Wohlfarth, W. W. Cologne; Univ. Cologne (1973). 72p. (In German). INIS.

Thesis.

An investigation of excited levels in ^{4}He of $20.0 \leq E_x \leq 26.0$ MeV was possible with the help of the three-particle reactions D (^{3}He, P^{3}He) N and D (^{3}He, PT) P at an injection energy of $E_{^3He} = 22.5$ MeV. The angular distributions for these states in the recoil nucleus system were evaluated by a model-independent theory of the sectional decay, and limits of spin and parity of these states are given. (GE)

Nuclear Properties and Reactions, 6 ≤ A ≤ 19

Refer also to abstracts 1926, 2080, 2095, and 2103.

2084 (AECL-5121, pp 12–14) LIFETIME OF THE 1.89 MeV, 2$^+$ LEVEL OF ^{18}Ne: TWO BODY CONTRIBUTIONS TO E2 TRANSITION RATES. McDonald, A. B.; Haeusser, O.; Forster, J. S.; Alexander, T. K.; Broude, C.; Khanna, F. C.; Mitchell, I. V. May 1975.

In Physics Division progress report, 1 January–31 March 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

2085 (AECL-5121, pp 51-2) THICK TARGET NEUTRON YIELDS AND SPECTRAL DISTRIBUTIONS FROM THE ^{7}Li(p,n)(d,n) AND ^{9}Be(p,n)(d,n) REACTIONS. Lone, M. A.; Bigham, C. B.; Fraser, J. S.; Schneider, H. R.; Alexander, T. K.; Ferguson, A. J.; McDonald, A. B. May 1975.

In Physics Division progress report, 1 January–31 March 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

2086 (ITP-75-36P) INFLUENCE OF ANHARMONIC EFFECTS ON COLLECTIVE "NONRESPIRATORY" 0$^+$ EXCITATIONS IN MAGIC NUCLEI. Steshenko, A. I.; Izotov, V. G. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

In the framework of the generalized hyperspheric function method the influence of the kinematic and dynamic anharmonics on the spectrum of collective 0$^+$ excitations of magic nuclei is studied. The specific calculations are performed using a set of central exchange NN—potentials for the nuclei 0^{16} and Ca^{40}. It is shown that the allowance for the anharmonism of the nuclei considered changes considerably the spectrum picture as compared with the spectrum of the above-mentioned excitations of the harmonic approximation. (2 figures, 2 tables) (auth)

2087 (JINR–E2-8936) EXCITATION OF GIANT DIPOLE RESONANCE BY NEUTRAL WEAK CURRENTS IN NEUTRINO SCATTERING ON ^{12}C and ^{16}O. Dadayan, N. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 16p. Dep. NTIS (US Sales Only) $4.00.

The cross section of excitation of giant dipole resonance is calculated for the reactions $\nu(\bar{\nu}) + C(O) \rightarrow \nu'(\bar{\nu}') + {}^{12}C^*({}^{16}O^*)$ by using the Weinberg model. The collective states are described in terms of the generalized Goldhaber-Teller model. The dependence of the cross section on parameter of the Weinberg theory $\sin^2\theta_W$ is investigated. (auth)

2088 NEW TECHNIQUE FOR PARITY MEASUREMENT USING POLARIZED DEUTERONS. Kuehner, J.A.; Green, P.W.; Jones, G.D.; Petty, D.T. (Tandem Accelerator Laboratory, McMaster University, Hamilton, Ontario, Canada L8S 4K1). Phys. Rev. Lett. 35: No. 7, 423-426 (18 Aug 1975).

A new model-independent method for determining the parity of a state as either $\pi = (-)^J$ or $\pi = (-)^{J+1}$ in odd-odd nuclei is described. The technique requires a polarized deuteron beam to initiate a (d, α) reaction on an even-even target with detection of the reaction products near 0° or 180°. The method is demonstrated using the reaction $^{12}C(d, \alpha)^{10}B$. (auth)

2089 ELASTIC SCATTERING OF 50-MeV π^+ FROM ^{12}C. Amann, J.F.; Barnes, P.D.; Doss, M.; Dytman, S.A.; Eisenstein, R.A.; Thompson, A.C. (Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213). Phys. Rev. Lett. 35: No. 7, 426-429 (18 Aug 1975).

Results for the elastic scattering of 50-MeV π^+ on ^{12}C are presented. Contrary to experience at energies above 100 MeV, simple optical models (with parameters derived from π-N phase shifts) give poor fits to the data. Forcing good fits yields potentials that are pion producing or in violation of unitarity. We conclude that improved optical potentials will be required to describe low-energy data. (auth)

2090 POSSIBLE EVIDENCE FOR THE EXISTENCE OF STRANGENESS ANALOG STATES. Schiffer, J.P. (Argonne National Laboratory, Argonne, Illinois 60439); Lipkin, H.J. Phys. Rev. Lett. 35: No. 11, 708-710 (15 Sept 1975).

Evidence supporting the validity of a simple symmetry in hypernuclei, suggested ten years ago, is found in recently published data on $_\Lambda{}^9$Be, $_\Lambda{}^{12}$C, and $_\Lambda{}^{16}$O. (auth)

2091 SOME FEATURES OF KINEMATICS OF REACTIONS INDUCED BY LITHIUM IONS. Gol'dberg, V. Z.; Rudakov, V. P.; Timofeev, V. A. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 21: No. 5, 1001-1007(May 1975). (In Russian)

It is shown that in α and t cluster transfer reactions induced by the ^{6}Li and ^{7}Li ions the shapes of the spectra and of the angular distributions at small angles and high excitation energies of residual nuclei are predominantly determined by the momentum distributions of the above mentioned clusters in the ^{6}Li and ^{7}Li nuclei. Excluding the corresponding dependence from the differential cross sections one can use the measured spectra to estimate the reduced α particle widths of the states of the residual nuclei whose quantum numbers are known. (4 figures) (auth)

2092 STUDY OF THE REACTION (π^+,π^+p) ON CARBON AT LARGE RECOIL MOMENTA AT 60 AND 112 MeV MESON ENERGY. Gismatullin, Yu. R.; Lantsev, I. A.; Ostroumov, V. I. (Leningrad Polytechnical Inst.). Yadern. Fiz.; 21: No. 5, 950-955(May 1975). (In Russian)

The nuclear emulsions are used to study the reaction (π^+, π^+p) on carbon nuclei at large recoil momenta ($q \geq 150$ MeV/c) and 60 and 112 MeV pion energy. Momentum and angular spectra of recoil nuclei, angular and energy distributions of protons, differential cross sections of pion scattering are obtained and compared with the pole approximation. (7 figures) (auth)

2093 SECOND-CLASS CURRENTS IN THE BETA DECAY OF NEON-19. Vantine, H. C. Princeton, NJ; Princeton Univ. (1974). 181p. University Microfilms Order No. 75-6715.

Thesis (Ph. D.).

The energy dependence of the angular distribution of the positrons emitted from polarized ^{19}Ne nuclei in the mirror transition ^{19}Ne yields ^{19}F has been measured. The angular distribution of positrons emitted from spin ½ nuclei with polarization p is proportional to (1 + APv/c cos theta), where v is the positron velocity and theta is the angle between the positron momentum and the nuclear polarization axis. The asymmetry parameter has been shown to consist of two terms: an energy independent term A(O), which is uniquely determined by the ft value, and an energy dependent part, DELTAA, which depends sensitively on the weak magnetism term and on an induced axial tensor term. In an analog transition this axial tensor term can arise only from a second class current. The nuclei are polarized by forming an atomic beam of ^{19}Ne atoms in the $^1S_0$ atomic state and passing this beam through a Stern-Gerlach type magnet. The polarized nuclei are collected in a bulb for a period of a few seconds, during which they suffer only a small (approximately 15 percent) depolarization. Two plastic scintillator-phototube assemblies located on the polarization axis detect the decay positrons. The energy independent part of the asymmetry parameter, A(O), is .0391(7) in agreement with the ft value prediction .0399(10). The energy dependent part of the asymmetry parameter, DELTAA, is .0149(12) which is larger than the value predicted by weak magnetism alone .0084(1), and indicates the presence of a second class current. This corresponds to a value for the form factor d of 265(40). (auth)

2094 ISOSPIN FORBIDDEN ^{14}N(alpha,alpha)^{14}N(2.31) REACTION. Chen, L. C. C. Madison, WI; Univ. of Wisconsin (1974). 94p. University Microfilms Order No. 74-26,483.

Thesis (Ph. D.).

Extensive new data are presented on the isospin-forbidden ^{14}N(alpha,alpha$_1$)^{14}N(2.31) reaction in 20 to 30 keV steps for 7.6 less than E/sub alpha/ less than 16.9 MeV. The differential cross sections were measured simultaneously at 11 to 16 angles in a differentially pumped gas scattering chamber. The strong resonant behavior in the cross sections indicates the appropriateness of compound nucleus formalism. The cross sections are expanded in partial waves. There are 2/sup L/ sets of S-matrix elements which give identical angular distributions. L is the maximum l-value necessary to give satisfactory fits to the data. This maximum varies from 3 to 7 in present experiment. The ambiguities

are removed by applying some unique properties among the ambiguous solutions. The selected S-matrix element is parameterized as a coherent sum of Breit-Wigner resonances for each partial wave. This procedure gave the level parameters for 151 isospin-mixed ^{18}F states and uniquely determined their spins and parities. These level parameters satisfactorily reproduce all the data. The ^{18}F states obtained in the present experiment are compared with those seen via $^{16}O(d,alpha_1)^{14}N$. Many correspondences are found. A number of levels have been identified as the analogues of T equals 1 states in ^{18}O. The isospin allowed $^{14}N(alpha,alpha_0)^{14}N$ data is extended from 10.3 MeV to 7.67 MeV. These data are reported without analysis. The behavior of complex zeros of scattering amplitude is studied in sample regions of the present experiment. For the "physical" solution, the position of all complex zeros has a tendency of rotating in the same direction in the complex plane as energy increases. In a computer experiment, the complex zeros simulated by some arbitrary resonances show the same characteristics. The possible application of this property is discussed. (auth)

Nuclear Properties and Reactions, 20 ≤ A ≤ 38

Refer also to abstract 2080.

2095 (AECL-5121, pp 23-24) SUPERALLOWED BETA-DECAY OF ^{18}Ne, ^{22}Mg, AND ^{26}Si. Hardy, J. C.; Geiger, J. S.; Graham, R. L.; Schmeing, H. May 1975.

In Physics Division progress report, 1 January–31 March 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

2096 COMMENT ON "PREDICTION OF WEAK-COUPLING STRUCTURE FROM A SHELL-MODEL BASIS". Nann, H.; Wildenthal, B.H. (Cyclotron Laboratory, Michigan State University, East Lansing, Michigan 48824); Saha, A.; Seth, K.K. Phys. Rev. Lett. 35: No. 9, 609-611 (1 Sept 1975).

The theoretical predictions of Wildenthal, Nann, and Seth about weak-coupling relations between the $0_{1\ 2}{}^+$ states of ^{32}S and the $3/2_1{}^+$ and $3/2_3{}^+$ states have been experimentally confirmed and the weak-coupling picture shown to extend to a quadruplet of states in ^{33}Cl which have significant parentage in the $2_1{}^+$ state of ^{32}S. (auth)

2097 EVIDENCE FOR INTERMEDIATE STRUCTURE IN THE INELASTIC SCATTERING OF POLARIZED PROTONS FROM ^{26}Mg AND ^{27}Al. Glashausser, C.; Robbins, A.B.; Ventura, E.; Baker, F.T.; Eng, J.; Kaita, R. (Department of Physics, Rutgers University, New Brunswick, New Jersey 08903). Phys. Rev. Lett. 35: No. 8, 494-497 (25 Aug 1975).

Structure of variable widths from about 0.3 to 1.5 MeV has been observed in analyzing-power excitation functions for inelastic proton scattering from ^{26}Mg and ^{27}Al. Statistical tests and significant cross correlations show that it is very unlikely that this structure is the chance effect of random fluctuations. Thus these data are evidence for intermediate structure. (auth)

2098 GAMMA DECAY OF THE 9.042- AND 9.805-MeV STATES IN ^{23}Na. KeKelis, G.J.; Lumpkin, A.H.; Fox, J.D. (Department of Physics, The Florida State University, Tallahassee, Florida 32306). Phys. Rev. Lett. 35: No. 11, 710-713 (15 Sept 1975).

$^{12}C(^{12}C,p\gamma)^{23}Na$ proton-γ angular correlations were measured at E_p=38.82 MeV for the 9.042– and 9.805-MeV states in ^{23}Na which decay to levels at 7.270, 6.235, and 5.534 MeV with branching ratios of 20%, 60%, and 20%, respectively, for the 9.042–MeV state, and 30%, 50%, and 20%, respectively, for the 9.805-MeV state. Angular correlations and lifetime data eliminate 17/2 assignments for either state. (auth)

2099 ANOMALOUS ϵ/β^+ DECAY BRANCHING RATIOS: A THEORETICAL EXPLANATION. Firestone, R.B.; Warner, R.A.; McHarris, W.C. (Department of Chemistry, Cyclotron Laboratory, and Department of Physics, Michigan State University, East Lansing, Michigan 48824); Kelly, W.H. Phys. Rev. Lett. 35: No. 11, 713-716 (15 Sept 1975).

Anomalous ϵ/β^+ branching ratios for hindered allowed transitions in ^{145}Gd and ^{143}Sm decay are explained in terms of second-order corrections to normal allowed theory. These calculations lead to correction factors as large as 1000 in nuclei near Z=80, and explain a smaller anomaly for ^{22}Na decay. A simplified equation is presented to estimate skew ratios, $(\epsilon/\beta^+)_{exp}/(\epsilon/\beta^+)_{theor}$, for moderately hindered transitions. (auth)

2100 HIGHLY EXCITED ISOMERIC STATE IN ^{38}K. Iordachescu, A.; Ivanov, E. A.; Pascovici, G. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 5, 519-525 (1975).

An isomeric state of 3456 ± 0.9 keV excitation energy and 22.1 ± 0.7 μs half-life was observed in ^{38}K and its decay scheme studied. The spins of the states involved in the decay were determined by angular distribution measurements for the delayed gamma rays. The isomeric state has $J^\pi = 7^+$, and it decays to levels of 3418 and 2646 keV with $J^\pi = 6^-$ and 4^-, respectively. (auth)

2101 ELECTRIC QUADRUPOLE INTERACTIONS OF ^{20}F ($T_{\frac{1}{2}}$ = 11 sec) IN MgF_2 MONOCRYSTALS. Stoeckmann, H. J. Heidelberg; Heidelberg Univ. (1972). 51p. (In German). INIS.

Thesis.

Measurements show that it is possible to extend nuclear resonance experiments after capture of polarized neutrons to noncubic crystals. The quadrupole coupling constant e^2qQ of ^{20}F in MgF_2 was measured for the first time, and the asymmetry parameter eta was redetermined. By means of known data from γ-angular correlation measurements in the 197-keV state of ^{19}F, the quadrupole moment of ^{20}F could be calculated. The method outlined is probably the most accurate for the determination of field gradients in F compounds. (auth)

2102 STUDY OF THE REACTION $^{35}Cl(p,\gamma\gamma)^{36}Ar$ AT THE PROTON ENERGY E_p = 533 keV. Grosswendt, B. Brunswick; Technische Univ. (1972). 82p. (In German). INIS.

Thesis.

Triple correlation experiments were carried out on the $^{35}Cl(p,\gamma\gamma)^{36}Ar$ reaction at the proton energy of E_p = 533 keV for studies of the 9.025 MeV state in the ^{36}Ar nucleus. The analysis of the gamma cascades between the ^{36}Ar states at 9.025 and 1.97 MeV, and the ground state resulted in the spin assignment of $J_1 = 2^+$ for the proton capture level. Comparison of the ^{36}Ar level scheme with states in the isobar ^{36}Cl nucleus indicated that the 2^+ state in ^{36}Ar as measured in this study may be the isobar state analogous with 2^+ level at 1.949 MeV in the ^{36}Cl spectrum. (auth)

2103 NUCLEAR MAGNETIC RESONANCE INVESTIGATIONS ON ^{14}N, ^{15}N, ^{33}S, ^{95}Mo, ^{97}Mo, ^{115}Sn, ^{117}Sn, AND ^{119}Sn. Nolle, A. Tuebingen, Ger.; Tuebingen Univ. (1973). 56p. (In German). INIS.

Thesis.

Ratios of the Larmor frequencies of the nitrogen isotopes ^{14}N and ^{15}N, of the molybdenum isotopes ^{95}Mo and ^{97}Mo, of the tin isotopes ^{115}Sn, ^{117}Sn, and ^{119}Sn, as well as of ^{33}S and ^{85}Rb were measured using the nuclear resonance method. The magnetic moment of ^{33}S which only has a very weak nuclear signal was very accurately determined. (auth)

2104 EXPERIMENTAL INVESTIGATION OF NUCLEAR REACTIONS WITH ^{32}S AND ^{40}Ca IONS. Richter, M. Munich; Technische Univ. (1973). 26p. (In German). INIS.

Thesis.

The elastic scattering of the systems $^{32}S + ^{32}S$ and $^{40}Ca + ^{40}Ca$ was investigated near and above the Coulomb barrier. Angular distributions and excitation functions were thus recorded. The data were analyzed using the optical model. Flat, energy-dependent real potentials were obtained. Products of transfer reactions were directly measured for the systems $^{32}S + ^{28}Si$, $^{32}S + ^{32}S$, $^{32}S + ^{40}Ca$ and $^{32}S + ^{42}Ca$. (auth)

2105 INVESTIGATION OF ELASTIC AND INELASTIC SCATTERING OF FAST NEUTRONS ON ^{24}Mg AND ^{28}Si. Joppich, G. Erlangen, Ger.; Erlangen-Nuernberg Univ. (1974). 64p. (In German). INIS.

Thesis.

At the Erlangen 14-MeV neutron source the differential cross sections were measured on the nuclei magnesium 24 and silicium 28. To separate the elastic and inelastic scattered neutrons the time of flight method was used with application to the associated α-particles. The measured data were analyzed by the help of the methods of coupled channel and DWBA. The analysis was carried out in the model of the axial symmetric rotator. The quadrupole deformation parameters were obtained as 0.63 for magnesium and 0.45 for silicium. (auth)

2106 INVESTIGATION OF THE (^3He,n) REACTION ON NUCLEI OF THE ($2s_{\frac{1}{2}} - 1d_{\frac{3}{2}}$) SHELL. Friedland, U. Frankfurt am Main; Univ. Frankfurt am Main (1973). 87p. (In German). INIS.

Thesis.

The (^3He,n) reaction on the target nuclei $^{28,29,30}Si$, ^{32}S and $^{35,37}Cl$ was investigated with an injection energy of 14 MeV or 13 MeV (^{37}Cl). The neutrons were detected by a neutron spectrometer consisting of five recoil proton telescopes. The angular distributions for the ground state transitions of these (^3He,n) reactions exhibit a distinct L = 0 structure which, however, also contain relatively small L = 2 shares in both chlorine isotopes correspond-

ing to the angular momentum selection rules. The experimental angular distributions are compared with DWBA calculations which are based on shell model calculations. The strength of the (^{3}He,n) transitions is reproduced within a factor of about 2 by the DWBA calculations. (GE)

2107 MEASUREMENTS OF G-FACTORS FOR THE CASE OF INSEPARABLE ENERGIES OF γ-γ-CASCADE. Reuse, B. Giessen, Ger.; Univ. Giessen (1970). 47p. (In German). INIS. Thesis.

Investigations of differential g-factor determination for separable and inseparable γ-energies were conducted. It resulted that a measurement at inseparable γ-energies determines the sign of the g-factor up to a nuclear level width of 0.1 ns. The combination of integral and differential measurement leads to the determination of g-factors of not yet measured nuclear levels by disturbed γ-γ-angular correlations. (GE)

2108 LIFETIME STUDY OF ^{37}Ar AND GAMMA-RAY STUDY OF ^{96}Tc. Kruzek, R. G. Lexington, KY; Univ. cf Kentucky (1973). 147p. University Microfilms Order No. 75-5832. Thesis (Ph. D.).

The ^{37}Cl(p,n gamma)^{37}Ar reaction was used to produce ^{37}Ar in its various excited states and their mean nuclear lifetimes were measured through the Doppler shift attenuation method. Proton bombarding energies ranged from 3.61 MeV to 5.80 MeV, and the ^{37}Ar recoils were stopped in the $CdCl_2$ target. The results of the lifetime study are as follows: 1.410-MeV level (620 +- 185 fs), 2.217-MeV level (540 +- 145 fs), 2.490-MeV level (755 +- 170 fs), 2.796-MeV level (23 +- 8 fs), 3.170-MeV level (81 +- 15 fs), 3.186-MeV level (310 +- 80 fs), 3.272-MeV level (38 +- 15 fs), 3.516-MeV level (93 +- 35 fs), 3.526-MeV level (greater than 1120 fs), and 3.605-MeV level (82 +- 25 fs). A measurement of the various de-excitation gamma-ray energies was also made. These results are compared with values reported from five other studies and are also discussed in terms of transition strengths computed in a recent shell model calculation. The low lying levels of ^{96}Tc were determined through a study of the de-excitation gamma-rays from the ^{96}Mo(p,n gamma)^{96}Tc reaction. The identified transitions in ^{96}Tc and the associated gamma-ray energies are given. A measurement of the half-life of the 34.2-keV isomeric state was obtained through the de-excitation gamma-ray and was determined to be 52 +- 2 minutes. The energies of other gamma-rays which were observed in the spectra but which could not be conclusively placed in the level scheme are tabulated. (auth)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstracts 683, 2080, 2086, 2104, 2107, and 2117.

2109 (INIS-mf-1698, pp 312-314) ACTIVATION EXPERIMENTS BY PHOTONEUTRONS. Lakoshi, L.; Veresh, A. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

By an activation method for neutrons having an energy of 830 keV from a Na–Be source, effective cross-sections were measured for (n,gamma) and (n,n') reactions on Mn, Ag, Cd, In, I, Sm, Er, Lu, Ir and Au. Absolute values of the cross-sections were obtained by normalizing to the cross-section of the Au-197 (n, gamma) Au-198 reaction. (tr-SJR)

2110 MAGNETIC MOMENT OF THE 6_1^+ STATE IN ^{42}Ca. Young, L.E.; Brenn, R.; Bhattacherjee, S.K.; Fossan, D.B.; Sprouse, G.D. (Department of Physics, State University of New York, Stony Brook, New York 11794). Phys. Rev. Lett. 35: No. 8, 497-500 (25 Aug 1975).

The g factor of the 6_1^+ state at 3189 keV ($T_{1/2}$=5.4 nsec) in ^{42}Ca has been remeasured with a significant improvement in accuracy by a pulsed-beam time-differential method using an in-beam superconducting magnet at 61 kG. The g factor obtained is $g(6_1^+) = -0.415 \pm 0.015$. A $g(\nu f_{7/2}) = -0.53 \pm 0.02$ is extracted from this result by use of the coexistence wave function due to Erikson; this value is in agreement with the single-particle value of −0.547 indicating a negligible orbital anomaly δg_l. (auth)

2111 EFFECTS OF STRONG ABSORPTION IN ^{40}Ca+^{40}Ca ELASTIC SCATTERING. Doubre, H.; Roynett, J.C.; Jacmart, J.C.; Poffé, N.; Riou, M. (Institut de Physique Nucléaire, 91406 Orsay, France); Plagnol, E.; de Saintignon, P. Phys. Rev. Lett. 35: No. 8, 508-510 (25 Aug 1975).

A study of the elastic scattering for the ^{40}Ca+^{40}Ca system has been performed in the 110–150– and 170–200-MeV laboratory energy ranges. Structureless excitation functions and smooth angular distributions, rapidly decreasing with angle, suggest a strongly absorptive process, unexpected from angular-momentum-matching considerations. (auth)

2112 FILTRATION OF 4.0 ± 0.2 MeV NEUTRON FLUX THROUGH Fe AND ^{208}Pb. Morozov, V. M.; Zubov, Yu. G.; Lebedeva, N. S. (Inst. of Atomic Energy, Moscow). Yadern. Fiz,; 21: No. 5, 945-949(May 1975). (In Russian)

The differential elastic scattering cross sections and the total cross section of the Fe and ^{208}Pb nuclei with the 40 ± 0.2 MeV neutron flux are studied in a filtration experiment. The results have confirmed the conclusion that there do not exist two incoherent mechanisms of elastic scattering of neutrons and that it is impossible to describe a nonmonoenergetical neutron flux by a wave packet with the energy uncertainty equaling the target thickness. Comparison of the obtained total cross sections of the filtrated and nonfiltrated fluxes with the most accurate available data yields a conclusion that, in the neutron energy region under consideration, the total cross sections of both nuclei show the the peaks with large amplitudes and comparatively small widths in contrast to widely known opinion about the smooth total cross sections of the moderate-weight and heavy nuclei in the energy region under consideration. (2 figures, 1 table) (auth)

2113 SEARCH FOR NEUTRON DE-EXCITATION OF NUCLEAR ISOMERS. Fleming, R. F. Ann Arbor, MI; Univ. of Michigan (1975). 108p. University Microfilms Order No. 75-20,343.

Thesis (Ph. D.).

This work is concerned with the experimental observation of the inelastic neutron scattering reaction wherein the target nuclide is in a long-lived isomeric state and one of the reaction products is this same nuclide in its ground state. A series of measurements was conducted in which the neutrons scattered from a target in the core of the Ford Nuclear Reactor were viewed with a hydrogen gas-filled proton recoil proportional detector. The targets contained populations of 8.94 hour Co-58m, 9.3 hour Eu-152m, 253 day Ag-110m, and 127 year Ag-108m. In no case was a cross section statistically different from zero observed. For the case of the two silver isomers, the magnitude of the statistical uncertainty corresponded to a cross section of 0.2 barns. The result of the measurement is to place this upper limit on the cross section for the reaction. Methods of measurement of the cross-section are analyzed. These include the observation of the mono-energetic neutrons emitted using either an incore or an excore target, and the measurement of the increase in the number of ground state nuclei. The cross section measurement sensitivity of each method is calculated for several selected target isomers. (auth)

2114 VECTOR ANALYZING POWER IN THE (d,p) AND (d,t) REACTIONS ON EVEN NICKEL ISOTOPES. Huttlin, G. A. Notre Dame, IN; Univ. of Notre Dame (1975). 143p. University Microfilms Order No. 75-13,093.

Thesis (Ph. D.).

Measurements of the vector analyzing power were made for the reactions ^{58}Ni(anti d,t)^{57}Ni, ^{60}Ni(anti d,t)^{59}Ni, ^{62}Ni(anti d,t)^{61}Ni, and ^{62}Ni(anti d,p)^{63}Ni at the respective deuteron bombarding energies 16.5, 15.0, 15.0, and 10.0 MeV. These data were compared with calculations based on the distorted-wave Born approximation. The observation of the dependence of the angular distributions of the vector analyzing power on the total angular momenta and parities carried by the transferred neutrons provided spin assignments for levels in ^{57}Ni, ^{59}Ni, ^{61}Ni, and ^{63}Ni. The unambiguous spin assignments follow the excitation energies are in MeV): ^{57}Ni–g.s., $3/2^-$; 0.769, $5/2^-$; 1.113, $1/2^-$; 2.577, $7/2^-$; 3.23, $7/2^-$; ^{59}Ni–g.s., $3/2^-$; 0.340, $5/2^-$; 0.466, $1/2^-$; 0.878, $3/2^-$; 1.303, $1/2^-$; 1.949, $7/2^-$; 2.630, $7/2^-$; ^{61}Ni–g.s., $3/2^-$; 0.283, $1/2^-$; 0.656, $1/2^-$; 1.100, $3/2^-$; 1.186, $3/2^-$; 1.457, $1/2^-$; 2.90, $1/2^-$; 3.30, $1/2^-$; ^{63}Ni–g.s., $1/2^-$; 0.087, $5/2^-$; 0.155, $3/2^-$; 0.515, $3/2^-$; 1.003, $1/2^-$; 1.327, $7/2^-$; 2.297, $5/2^+$; 2.700, $1/2^-$; 2.953, $1/2^+$; 3.292, $5/2^+$; 3.932, $5/2^+$; 3.951, $5/2^+$; 4.267, $1/2^+$; 4.387, $5/2^+$. Some less definitive spin assignments suggested by the data are: ^{59}Ni–3.040, $(1/2)^-$; ^{61}Ni–1.611 $(1/2)^-$; 1.730, $(1/2)^-$; 2.470, $(1/2)^-$; ^{63}Ni–1.294, $(1/2)^+$; 2.519, $(1/2)^+$; 4.063, $(1/2^+)$; 4.074, $(1/2^+)$. (auth)

2115 ISOBARIC ANALOG STATE TRANSITIONS IN (p,n) REACTIONS ON ^{48}Ca, ^{90}Zr, ^{120}Sn, AND ^{208}Pb AT 25, 35, AND 45 MeV. Doering, R. R. East Lansing, MI; Michigan State Univ. (1974). 124p. University Microfilms Order No. 75-7154. Thesis (Ph. D.).

Differential cross sections have been measured for (p,n) reactions to the isobaric analogs of the targets ^{48}Ca, ^{90}Zr, ^{120}Sn, and ^{208}Pb at proton bombarding energies of 25, 35, and 45 MeV. The

angular distributions include 0^0 and generally extend from 10^0 to 160^0 in 5^0 steps. Neutron spectra at these scattering angles have been obtained with the time-of-flight technique. The isospin-flip strength of a phenomenological nucleon-nucleon force has been determined with microscopic DWBA calculations including the "knockon" exchange amplitude. The strength required to fit the data decreases with increasing bombarding energy. At the higher proton energies a realistic G-matrix effective interaction also provides a reasonable account of the observed angular distributions. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 2080, 2103, 2109, and 2114.

2116 (JINR-E7-9065) OBSERVATION OF DIRECTIONAL ANISOTROPY OF QUASIMOLECULAR Kx-RAYS EMITTED IN 67-MeV Ni + Ni COLLISIONS. Frank, W.; Gippner, P.; Kaun, K. H.; Manfrass, P.; Tret'yakov, Yu. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1975. 16p. Dep. NTIS (US Sales Only) $4.00.

By bombarding natural Ni targets with 67 MeV $^{60}Ni^{4+}$ ions a quasimolecular X-ray continuum has been obtained, which extends beyond the KX-ray energy of the quasiatom with Z = 56. This continuum shows strong directional asymmetry with a maximum at the KX-ray energy of the hypothetical united atom. (5 figures) (auth)

2117 SYSTEMATICS OF PION AND PROTON INTERACTIONS WITH Ni NUCLIDES. Jackson, H.E.; Kovar, D.G.; Meyer-Schützmeister, L.; Segel, R.E.; Schiffer, J.P.; Vigdor, S.; Wangler, T.P. (Argonne National Laboratory, Argonne, Illinois 60439); Burman, R.L.; Drake, D.M.; Gram, P.A.M.; Redwine, R.P.; Lind, V.G.; Hatch, E.N.; Otteson, O.H.; McAdams, R.E.; Cook, B.C.; Clark, R.B. Phys. Rev. Lett. 35: No. 10, 641-644 (8 Sept 1975).

γ-ray spectra have been observed following the interaction of 220-MeV π^+ and π^- and 200-MeV protons with ^{58}Ni and ^{60}Ni and 100-MeV π^+ with ^{58}Ni. Product nuclides have been identified from characteristic γ-ray lines corresponding to total cross sections of ~500 mb. The systematic trends with projectile and energy are explored; rather substantial differences are found between pions and protons. (auth)

2118 MEASURING THE SUBMICROSECOND LEVEL LIFE-TIMES BY THE SINGLE CRYSTAL SCINTILLATION TIME SPECTROMETER. Budzynskii, M.; Butsev, V. S.; Gromov, K. Ya. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 5, 913-916(May 1975). (In Russian)

The scintillation single-crystal time spectrometer is used to measure the life-times of excited states in the nuclei ^{79}Kr, ^{133}La, ^{141}Pm, ^{155}Dy, ^{159}Eu, ^{161}Er, ^{167}Yb, and ^{169}Tm. (2 figures, 1 table) (auth)

2119 DECAY OF $p_{1/2}$ AND $f_{1/2}$ ANALOG RESONANCES IN ^{61}Cu. Kraft, O. E.; Naumov, Yu. V.; Sizov, I. V. (Leningrad State Univ.). Yadern. Fiz.; 21: No. 5, 919-924(May 1975). (In Russian)

The γ decay of $p_{1/2}$ and $f_{1/2}$ analog resonances produced in the reaction $^{60}Ni(p,\gamma)^{61}Cu$ are studied at proton energies 1856, 1873 ($p_{1/2}$) and 1674 ($f_{1/2}$) keV. The population intensities of ^{61}Cu levels are obtained up to 3.3 MeV and the decay schemes are constructed for each resonance. The values B(M1, σ) calculated from log ft are compared with the experimental values B(M1) for γ transitions from analog resonances. The experimental values of B(M1) for analog-antianalog transitions are compared with the calculation results. (3 figures, 1 table) (auth)

2120 TWO-BODY AND THREE-BODY CORRELATIONS IN Os-SHELL NUCLEI. Halderson, D. W. Lawrence, KS; Univ. of Kansas (1974). 108p. University Microfilms Order No. 75-6191.

Thesis (Ph. D.).

It is well known that conventional Brueckner calculations with modern nucleon-nucleon potentials have failed to reproduce experimental saturation properties of finite nuclei. The intent was to determine whether the discrepancies are due to the methods of calculation or the nucleon-nucleon potentials. Brueckner procedures which include only two-body correlations were applied to Os-shell nuclei. Calculations were performed with and without the Hartree-Fock condition, with and without partial occupation probabilities, and with various propagators and Pauli correction techniques. Then the entire class of three-body correlations was calculated by matrix solution of the Bethe-Faddeev equations. The convergence necessary to validate this technique was achieved by constructing a set of basic functions which contain no center of mass excitations and yet are still properly antisymmetrized. The two-body calculations yielded typical Brueckner results. The nuclei were underbound or the radii were too small. However, the three-body calculations yielded reasonable radii and moderate overbinding for the Reid soft core and Hamada-Johnston potentials. Therefore, the Bethe-Faddeev formalism has been shown to be a reasonable approach to calculation of the three-body correlations in finite nuclei; and the results of these calculations demonstrate that the underbinding and collapsed radii of two-body calculations were largely due to the uncalculated correlations. (auth)

2121 EFFECTIVE INTERACTION IN THE MASS 90 REGION. Chestnut, R. P. Stony Brook, NY; State Univ. of New York (1974). 116p. University Microfilms Order No. 75-5170.

Thesis (Ph. D.).

The differential cross section of the 1^+ (3.487 MeV) and 3^+ (3.635 MeV) levels in ^{88}Sr have been measured between laboratory angles of 20^0 and 110^0 in the inelastic scattering of 17.2 MeV protons. The measured cross sections are reasonably well predicted by DWBA calculations assuming realistic interactions and shell-model wave functions spanning a large basis space. It is found that the calculated cross sections are dominated by the components in the wave function involving the valence nucleons, and that the core polarization is relatively unimportant. Using particle gamma coincidence techniques, an upper limit of about 8 mu b/sr is placed on the forward-angle cross section for the excitation in (p,p') at E/sub p/ equals 17.2 MeV of the 4^- state in ^{90}Zr at 2.738 MeV. This upper limit is consistent with DWBA calculations using realistic interactions and reasonable wave functions. A 4^- state in ^{92}Zr is identified at 2.740 +- .010 MeV through the reaction $^{93}Nb(d,^3He)^{92}Zr$ at E/sub d/ equals 17.2 MeV. (auth)

2122 ANALOG RESONANCES IN ELASTIC AND INELASTIC SCATTERING OF POLARIZED PROTONS. King, H. T. Stanford, CA; Stanford Univ. (1975). 136p. University Microfilms Order No. 75-13,539.

Thesis (Ph. D.).

Analog resonances were studied in polarized and unpolarized proton scattering from the nucleus ^{86}Sr. For elastic scattering and inelastic scattering to the 2_1/sup +/ state of ^{86}Sr, excitation functions and on-resonance angular distributions were measured for all of the strong analog resonances between 4.5 and 7 MeV bombarding energy. For the d-wave resonances, elastic and (on-resonance) inelastic analyzing powers were measured, as well as inelastic spin-flip asymmetries, by use of a polarized beam and detection of proton-gamma coincidences. The polarized-beam experiments were indispensable in obtaining unambiguous spectroscopic results, and provided considerable information on the enhancement of the T/sub angle/ compound nuclear scattering in the vicinity of the IAR. Spectroscopic information was obtained for both elastic scattering and inelastic scattering to the 2_1/sup +/ state. The spectroscopic results from the IAR measurements were compared to those of a unified model calculation for the parent states in ^{87}Sr. The agreement was in general quite poor, indicating that a more complicated theoretical picture is probably needed to describe these high-lying analog states. A comparison of inelastic IAR parameters for the 4.81 MeV ($\frac{9}{2}^+$) resonance was made with those of another investigation which utilized a very different technique; the agreement was good. Good agreement was also found between the elastic spectroscopic factors from the present work and those from published studies of the reaction $^{86}Sr(d,p)^{87}Sr$. A model-independent procedure for extracting the energy-averaged compound elastic cross section was used on three d-wave resonances in the ^{86}Sr(vector p,p_0) reaction and the results were found to be in excellent agreement with compound nuclear theory. For inelastic scattering the CN cross section could not be extracted accurately with this method because of the larger number of decay widths to be determined; however, the inelastic results did indicate that the Hauser-Feshbach CN theory could not adequately account for the CN scattering, whereas the Engelbrecht-Weidenmuller CN theory provided consistent fits to all the data. (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 2080, 2099, 2103, 2108, 2109, 2113, 2115, 2118, and 2121.

2123 (DEU-75-5) ANNUAL REPORT 1972/73. Eichner, H.; Lieb, K. P. (Koeln Univ. (F. R. Germany). Inst. fuer Kernphysik). [nd]. 184p. (In German). INIS.

This report gives a survey on the research work and scientific/technical developments in the Institut fuer Kernphysik of Cologne University in the years 1972/73. Most of these projects were investigations of the mechanism of nuclear reactions and nuclear spectroscopy with the aid of the FN tandem accelerator of the institute. Other projects comprising work on nuclear physics, semiconductor detectors, and the expansion of the computer systems of the institute were continued. (auth)

2124 (JINR-E7-9029) QUASIMOLECULAR Kx-RAY EXCITATION BY BOMBARDING La TARGETS WITH La AND Xe IONS. Frank, W.; Gippner, P.; Kaun, K. H.; Zodan, H.; Tret'yakov, Yu. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1975. 15p. Dep. NTIS (US Sales Only) $4.00.

The X-ray emission in the 85-to-150 MeV Xe and 115 MeV La bombardments of thick natural La targets has been measured. The spectra and yields of X-ray emission are obtained. Continuous X-ray distributions have been found to lie beyond the target and projectile characteristic X-ray energies. The high energy parts of these continua are interpreted as K-radiation of quasimolecules with effective atomic numbers Z = 111 and Z = 114, respectively. (1 table, 1 figure) (auth)

2125 (JINR-P4-8972) STRENGTH FUNCTIONS OF THE β^+ DECAY OF $^{117-123}$Ba ISOTOPES. Ivanova, S. P.; Kuliev, A. A.; Salamov, D. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The strength functions of the allowed Gamov-Teller transitions of $^{117-123}$Ba isotopes were investigated in the framework of the random phase approximation with the residual pair and charge-exchange spin-spin forces taken into account. The single-particle level schemes in the spherical and deformed Saxon-Woods potential were used in calculations. The maximum of the strength function is predicted by the theory for Ba isotopes at the energy 4 to 5 MeV. In the formation of the maximum the main contribution is from the allowed a.u.-transitions p[404+] → n[404+] and p[413+] → [413+]. The maximum of the strength function for $^{117-123}$Ba is shifted to small excitation energies for an increase of the mass number, A. (auth)

2126 (JINR-P6-8903) DECAY OF NEUTRON-DEFICIENT NUCLEI WITH MASS NUMBER A = 139. Vylov, Ts.; Gromova, I. I.; Kalinnikov, V. G.; Kuznetsov, V. V.; Muminov, T. M.; Morozov, V. A.; Fominykh, V. I.; Usmanov, R. R.; Shavgulidze, Z. D. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 28p. (In Russian). Dep. NTIS (US Sales Only) $4.75.

The γ-ray spectra of isotopes of Nd, Pr and Ce with mass number A = 139 have been investigated. The positron, internal conversion electron and γ-γ coincidence spectra are also studied in the decay of ^{139}Pr. The quantum characteristics are ascribed to the excited states of the daughter nuclei. The life-time of the 255 keV ^{139}Ce states has been measured, and the comparison with the available model predictions is made. (9 figures, 4 tables) (auth)

2127 (JINR-P6-8962) INVESTIGATION OF THE DECAY OF DELAYED PROTON EMITTERS ^{121}Ba, ^{119}Ba, ^{116}Cs. Bogdanov, D. D.; Boborzhil, I.; Dem'yanov, A. V.; Karnaukhov, V. A.; Nefed'ev, O. K.; Petrov, L. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The BEMS-2 mass separator installed at a heavy-ion beam was used to investigate the delayed proton emitters ^{116}Cs, ^{119}Ba, and ^{121}Ba. From the measurements of positron-proton coincidences, the $Q_0 - B_p$ values (where Q_0 is the K-capture energy and B_p is the proton binding energy in the daughter nucleus) were bound to be (6.4 ± 0.3) MeV (6.35 ± 0.20) MeV, and (4.7 ± 0.2) MeV, respectively. An analysis of the shapes of the proton spectra by using the statistical model was performed. The results indicate the possible presence of a local resonance in the beta-transition strength function at the 5-MeV excitation energy in the daughter nucleus. (auth)

2128 (JINR-P6-9049) NATURE OF DOUBLY ODD ^{148,150,152}Tb NUCLEUS LEVELS. Alikov, B. A.; Vavryshchuk, Ya.; Gromov, K. Ya.; Malikov, M. M.; Marupov, N. Z.; Muminov, T. M.; Usmanov, R. R.; Yakhim, M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 8p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The lifetimes of I^+ excited states in doubly odd ^{148,150,152}Tb have been measured. The obtained results indicate the possibility of small deformation in those terbium nuclei. (1 figure, 1 table) (auth)

2129 DEFORMED 9/2+ STATES AND $\Delta J = 1$ ROTATIONAL BANDS IN ^{113,115,117,119}Sb NUCLEI. Gaigalas, A.K.; Shroy, R.E.; Schatz, G.; Fossan, D.B. (Department of Physics, State University of New York, Stony Brook, New York 11794). Phys. Rev. Lett. 35: No. 9, 555-558 (1 Sept 1975).

A set of $\Delta J = 1$ rotational bands has been observed on deformed (prolate) $9/2^+$ states in ^{113}Sb, ^{115}Sb, ^{117}Sb, and ^{119}Sb via (^{6}Li,3$n\gamma$) reactions on stable even Cd targets. The pattern of band spacings is suggestive of a $j = 9/2^+$ state coupled to a triaxial rotor. The energy systematics of the deformed states relate to the deformation-energy surfaces in this Z=50 closed-shell region. (auth)

2130 GIANT QUADRUPOLE RESONANCE IN DEFORMED NUCLEI. Kishimoto, T.; Moss, J.M.; Youngblood, D.H.; Bronson, J.D.; Rozsa, C.M.; Brown, D.R.; Bacher, A.D. (Cyclotron Institute, Texas A&M University, College Station, Texas 77843). Phys. Rev. Lett. 35: No. 9, 552-555 (1 Sept 1975).

With use of the ordinary quadrupole-quadrupole (Q-Q) interaction, a total splitting of the $K=0$, 1, 2 components in the giant quadrupole resonance (GQR) of about 6 MeV is predicted for deformed ^{154}Sm. A 0.8 ± 0.3-MeV broadening of the GQR is observed for ^{154}Sm relative to spherical ^{144}Sm with inelastic α scattering. A model requiring rigorous self-consistency is proposed which modifies the Q-Q interaction, reduces the predicted splitting to about 2 MeV, and removes inconsistencies in the strength of the interaction for $K=0$ and $K=2$ components in low-lying β and γ bands. (auth)

2131 ISOTOPIC DIFFERENCES IN THE CHARGE DISTRIBUTION OF EVEN MOLYBDENUM ISOTOPES FROM ELASTIC ELECTRON SCATTERING. Dreher, B. (Institut für Kernphysik, Universität Mainz, 65 Mainz, Germany). Phys. Rev. Lett. 35: No. 11, 716-719 (15 Sept 1975).

Elastic-electron-scattering cross sections for ^{92,94,96,98,100}Mo in an effective momentum transfer range of 0.6-2.1 fm^{-1} are analyzed in a practically model-independent way, using a Fourier-Bessel expansion for the charge distribution. The ratios of cross sections of neighboring isotopes yield differences of charge distributions, which exhibit pronounced shell effects. (auth)

2132 EXPERIMENTS TO TEST THE THEORY OF ISOBARIC ANALOG RESONANCES, CADMIUM, AND TIN ISOTOPES. Guzhovskii, B. Ya.; Zvenigorodskii, A. G.; Trusillo, S. V.; Abramovich, S. N. Yadern. Fiz.; 21: No. 5, 930-944(May 1975). (In Russian)

Absolute total (p,n)-reaction cross sections and the proton elastic scattering differential cross sections are measured for the target nuclei ^{110,112,114,116}Cd and ^{116,120,122,124}Sn in the region of the first isobaric analog resonances (IAR). The analysis is carried out by means of the theoretical formulae for averaged over energy cross sections using the least-square method. Resonance parameters are determined in both IAR decay channels and the consistency in the one-channel approximation is tested. A small but systematic discrepancy in the parameters ϵ^2_{pn} and ϵ^2_{pn} due to the one-channel approximation being incorrect, is detected. The observed dependences of the quantity Δ^2/ϵ^2 on the target nucleus are discussed for the s and d resonances and estimates are obtained indicating the dominating role of the internal mixing in formation of IAR for the nuclei in view. (5 tables, 3 figures) (auth)

2133 GAMMA-RAY EMISSION PROBABILITIES OF THE FISSION PRODUCTS ^{144}Ce-^{144}Pr, ^{106}Rh, ^{95}Zr. Debertin, K.; Schoetzig, U.; Walz, K. F.; Weiss, H. M. (Physikalisch-Technische Bundesanstalt, Braunschweig, Ger.). Ann. Nucl. Energy; 2: No. 1, 37-43(Jan 1975).

The fission products ^{144}Ce-^{144}Pr, ^{106}Rh and ^{95}Zr play an important role in the burn-up determination of fuel elements by means of γ-ray spectrometry. One of the crucial quantities in this field is the absolute γ-ray emission probability (intensity) for which values available in literature have not the desirable accuracy of 1 to 2%. By using Ge(Li)-spectrometers of known efficiency and sources calibrated by $4\pi\beta$-γ-coincidence methods, absolute γ-ray emission probabilities of ^{144}Ce-^{144}Pr, ^{106}Rh and ^{95}Zr were determined with an uncertainty of ±1% for the main γ-rays. (auth)

2134 COMPARISON OF REDUCED NORMALIZATIONS FROM (d,p) REACTION AND FROM ELASTIC PROTON SCATTERING ON ISOBARIC ANALOG RESONANCES. Steinmetz, B. Cologne; Univ. Cologne (1973). 87p. (In German). INIS.

Thesis.

The exact determination of reduced normalizations from (d,p)-reactions in the subcoulomb and quasicoulomb region allows the comparison with results from elastic proton scattering on isobaric analog resonances. The reactions ^{138}Ba(d,p)^{139}Ba and ^{142}Nd(d,p)^{143}Nd were thus measured at injection energies of 5.0, 6.0, 7.0 and 8.5 MeV at angles of 50°, 14°, 170° and partly at 90°. The spectroscopic factors and the reduced normalizations were determined with an average accuracy of 8.5%. By including measurements of the elastic proton scattering and (d,p)-measurements from other authors, it was possible to compare spectroscopic statements of altogether 39 analog states with secured (l,j)-values. (GE)

2135 DECAY OF Xe-119. Stippler, R. Brunswick; Technische Univ. (1972). 64p. (In German). INIS.

Thesis.

Isotopically pure sources of the Xe-119 isotope were produced on the ISOLDE mass separator which decayed into the daughter nuclei I-119 with a half-life of 19 min. The gamma lines belonging to this decay were identified on the basis of the known energies and relative intensities in the gamma spectrum measured. Evaluation of the single spectrum then resulted in a number of 309 lines in the energy range between 80 and 3,500 keV for the decay of the Xe-119 nucleus. (auth)

2136 NUCLEAR REACTIONS OF SILVER WITH 11.5- AND 300-GeV PROTONS. English, G. A. Lafayette, IN; Purdue Univ. (1974). 276p. University Microfilms Order No. 75-17,188.

Thesis (Ph. D.).

Cross sections have been determined for 74 nuclides formed in the interaction of natural Ag with 11.5- and 300-GeV protons. The technique of direct gamma-ray spectroscopy was used to determine the yields of nuclides; from this data charge-dispersion and mass-yield curves were constructed for the mass range 7 less than or equal to A less than or equal to 106. The mass-yield curve constructed at 11.5 GeV is seen to agree well with a curve at 29 GeV, the major exception being a plateau in the mass region near the mass of the target. The total reaction cross section obtained by integration of the mass-yield curve at 11.5 GeV is 1.05 +- 0.16b in excellent agreement with a calculated value of 1.13b. A semiempirical calculation predicts a much steeper decrease in the mass-yield than is observed experimentally. The experimental charge dispersions are essentially Gaussian. The full-widths at half-maximum and the difference between the most stable and the most probable charges can be correlated roughly with the transition between a spallation and a two-body breakup mechanism. A semiempirical calculation of charge dispersion predicts higher peak maxima than observed experimentally. (auth)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 1582, 2080, 2109, 2113, 2118, and 2128.

2137 (AD/A-004557) ELECTROEXCITATION OF GIANT RESONANCES BETWEEN 5 MeV AND 30 MeV EXCITATION ENERGY IN ^{165}Ho. Moore, G. L. (Naval Postgraduate School, Monterey, Calif. (USA)). Dec 1974. 63p. NTIS $4.25.

Thesis.

Giant resonances in ^{165}Ho were studied with inelastic scattering of electrons with 60 MeV to 105 MeV incident energy at a scattering angle of 75 degrees. From 5 MeV to 30 MeV excitation energy, five multipole resonances were observed of which only the dipole resonances have been previously reported. Reduced transition probabilities and multipolarity assignments have been made. The five resonances were observed at excitation energies of 9.6 (E0 or E2), 11.5 (E2), 12.3 (E1), 15.8 (E1), and 23.5 MeV (E2). The splitting of the dipole resonance observed in photonuclear reaction experiments with prolate spheroid nuclei is confirmed with inelastic electron scattering. (GRA)

2138 (JINR-P4-8947) SHELL CORRECTIONS TO THE DEFORMATION ENERGIES OF VERY HIGH SPIN NUCLEI (I ≲ 100). Neergard, K.; Pashkevich, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1975. 15p. (In Russian) Dep. NTIS (US Sales Only) $4.00.

Deformation energies at spins ≲ 100 of 16 rare earth nuclei were calculated including shell corrections obtained by a straightforward generalization of the Strutinsky method. Largely deformed shapes are predicted for some high rotational states. (3 figures) (auth)

2139 (JINR-P4-8965) INVESTIGATION OF THE DEPENDENCE OF EVEN-EVEN DEFORMED NUCLEUS COLLECTIVE PARAMETERS ON THE ANGULAR MOMENTUM. Karadzhov, D.; Mikhailov, I. N.; Nadzhakov, E.; Piperova, I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1975. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Numerical estimates of the nonadiabatic factors, determining the spin dependence of the basic collective parameters of even-even deformed nuclei, are obtained on the basis of a model proposed earlier by the authors. The results, obtained by solution of the equations at non-zero values of the spin, show the important role of the pairing in the deformability of rotating nuclei. (5 figures, 2 tables) (auth)

2140 (UCRL-51907) SPECTRA OF GAMMA-RAYS FROM CAPTURE OF 2 eV TO 9 x 10^4 eV NEUTRONS BY ^{181}Ta. Stelts, M. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). [nd]. Contract W-7405-Eng-48. 132p. Dep. NTIS $5.45.

Thesis.

Using new experimental techniques, the spectra of gamma-rays from the capture of neutrons by ^{181}Ta were measured at the Livermore 100-MeV linac for neutrons from 2 eV to 9 x 10^4 eV with a (Ge(Li)-NaI) three-crystal spectrometer. Individual primary gamma-ray lines were resolved to 1778-keV excitation in ^{182}Ta. Neutron resonances were resolved to 200-eV neutron energy. Data analysis techniques and codes were developed to extract positions and intensities of resolved transitions from the large data matrices accumulated in this experiment. Techniques were developed to unfold the unresolved gamma-ray spectra using the simple response of the three-crystal spectrometer. The resolved transition data were used to place 110 states with spin and parity assignments in the ^{182}Ta level diagram below 1780-keV excitation. A set of 1240 E1 transition strengths were analyzed to extract 1.38 +- 0.11 degrees of freedom for the most likely chisquared fit to the distribution of widths. The E1 strength function was extracted for E/sub gamma/ equals 4 to 6 MeV and compared with previous results. The gamma-ray spectra for E/sub gamma/ equals 1.5 to 6.1 MeV were unfolded for neutron energy groups between 20 and 9 x 10^4 eV. Below 5-MeV gamma-ray energy no dependence of the spectral shape on neutron energy was observed. (30 figures, 4 tables) (auth)

2141 CROSSING OF NEAR-SPHERICAL AND DEFORMED BANDS IN ^{186,188}Hg AND NEW ISOTOPES ^{186,188}Tl. Hamilton, J.H.; Ramayya, A.V.; Bosworth, E.L.; Lourens, W.; Cole, J.D.; Van Nooijen, B.; Garcia-Bermudez, G.; Martin, B.; Subba Rao, B.N.; Kawakami, H.; Riedinger, L.L.; Bingham, C.R.; Turner, F.; Zganjar, E.F.; Spejewski, E.H.; Carter, H.K.; Mlekodaj, R.L.; Schmidt-Ott, W.D.; Baker, K.R.; Fink, R.W.; Gowdy, G.M.; Wood, J.L.; Xenoulis, A.; Kern, B.D.; Hofstetter, K.J.; Weil, J.L.; Toth, K.S.; Ijaz, M.A.; Faltry, K.F.R. (Physics Department, Vanderbilt University, Nashville, Tennessee 37235). Phys. Rev. Lett. 35: No. 9, 562-565 (1 Sept 1975).

New isotopes ^{186,188}Tl ($T_{1/2}{}^{186}=4.5_{-1.5}{}^{+1.0}$ and 28 ± 2 sec and $T_{1/2}{}^{188}=71\pm1$ sec, respectively) have been identified. Conversion-electron, γ, γ-γ, and e-γ studies helped establish in ^{186,188}Hg two bands, one built on a slightly deformed ground state and one on a more strongly deformed shape with 0^+ band heads at 522 and 824.5 keV, respectively. Their crossing explains the anomalous behavior of $\mathcal{J}$ in the yrast cascades. States above and below the crossing in both bands support the existence of a well-defined second minimum in ^{188}Hg. (auth)

2142 *E2-E4* INTERFERENCE FOR (α, α') REACTIONS. Baker, F.T. (Department of Physics and Astronomy, The University of Georgia, Athens, Georgia 30602). Phys. Rev. Lett. 35: No. 7, 469-471 (18 Aug 1975).

Although Coulomb-nuclear interference is certainly not a misnomer for the description of recently observed interference structure for α-particle excitation of 4^+ states in permanently deformed nuclei, the details of the interference are shown to be more easily understood as interference between $L=2$ and $L=4$ amplitudes. (auth)

2143 HIGH-SPIN ANOMALIES IN Yb: CORIOLIS ANTIPAIRING VERSUS PAIR REALIGNMENT WITH A REALISTIC INTERACTION. Goodman, A.L. (Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213); Vary, J.P. Phys. Rev. Lett. 35: No. 8, 504-507 (25 Aug 1975).

The Hartree-Fock-Bogoliubov cranking equations are solved for ^{168}Yb and ^{170}Yb with an effective interaction obtained from the Reid soft-core nucleon-nucleon potential. Coriolis antipairing in ^{168}Yb and pair realignment in ^{170}Yb explain their anomalous high-spin spectra. (auth)

2144 NATURE OF THE 839-keV LEVEL IN ^{151}Gd. Kuznetsov, V. V.; Morozov, V. A.; Muminov, T. M. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 5, 917-918(May 1975). (In Russian)

The value of α_K is measured for the 443.8 keV transition in the ^{151}Gd nucleus. The multipolarity of that transition is found to be M1. The experimental results are used to discuss the nature of the 839 keV level in ^{151}Gd. (auth)

2145 INVESTIGATION OF THE EXCITATION OF ^{186}Re FROM (n,γ) REACTIONS. Glatz, J. Munich; Technische Univ. (1972). 56p. (In German). INIS.

Thesis.

From the reaction ^{185}Re(n,γ)^{186}Re, prompt and retarded γ-γ coincidences in ^{186}Re were investigated with Ge(Li) detectors. Two new isomers were found: the state at 99.4 keV with $T(\frac{1}{2})$ = 27 ns and the state at 330 keV with $T(\frac{1}{2})$ = 17.4 ns. The evaluation of the coincidence data led to the discovery or extension of 10 rotation bands with band heads below 700 keV. The level scheme is discussed in detail. (auth)

2146 PARITY MIXING IN NUCLEAR ENERGY LEVELS. Experiments on ^{180}Hf and ^{181}Ta Using Compton Backward Polarimeter. Simons, L. M. Bonn; Bonn Univ. (1973). 84p. (In German). INIS.

Thesis.

Parity violation in nuclear forces was found by measuring the circular polarization P of γ-rays emitted by unpolarized sources. The analyzing efficiency of the Compton backward polarimeter was calculated by the Monte-Carlo method and measured by circular polarization correlation of annihilation quanta to be (4.7 ± 0.3)% resp. (4.5 ± 0.5)%. The earlier Bonn result of 482-keV ^{181}Ta γ-polarization of $-(28 \pm 6)10^{-6}$ was found to be incorrect and simulated by a 2 per thousand asymmetry of magnet current. The final results in agreement with others are $P = -(5.8 \pm 8.1)10^{-6}$ 482 keV, ^{181}Ta; $P = -(1.9 \pm 0.6)10^{-3}$ 501 keV, ^{180}Hf. See also Z. Phys. 269(1974)421. (auth)

2147 STUDY OF THE OSMIUM ISOTOPES WITH THE (p,t) REACTION. Sharma, H. L. Minneapolis; Univ. of Minnesota (1974). 88p. University Microfilms Order No. 75-12,159.

Thesis (Ph. D.).

The (p,t) reaction at E/sub p/ equals 19.0 MeV has been used to study five isotopes of osmium (A equals 190, 188, 184, 187, 185) which lie in a transition region between the deformed rare earths and spherical nuclei. Cross-sections and angular distributions have been measured to states up to about two MeV of excitation in all cases except ^{188}Os and ^{190}Os in which states were seen up to 4 MeV. The energies of the J/sup pi/ equals 0$^+$ states and their summed intensities in percent of the ground state (in parenthesis) are: 912 (4.7), 1551 (1.8) and 1734 keV (6.3) in ^{190}Os, 1087 (5.7), 1480(3.7), 1704 (1.2), and 1765 keV (less than 1) in ^{188}Os and 1042 (8.4), 1982 (less than 1) and 2268 keV (less than 1) in ^{184}Os. The L equals 0 transitions seen in the odd isotopes are: 10, 77, 730 and 1657 keV in ^{187}Os and 1070 and 1213 keV in ^{185}Os. The results show no positive evidence for the existence of strongly populated shape isomeric 0$^+$ states similar to those seen in the transition region around N equals 88. In $^{188\ 190\ 192}$Os the lowest excited k equals 0 and k equals 4 bands fit quite well a two-phonon gamma vibrations. In addition to the rotational excitations based on the $\frac{1}{2}^-$ [510] state have been seen at 599 and 802 keV in ^{185}Os. Similar states have been seen in ^{187}Os. The lowest L equals 0 transfers to states in $^{185\ 187}$Os were found to have significantly lower intensity compared to the adjacent even-N nuclei. Calculations have been made to understand this phenomenon in terms of the blocking effect. (auth)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 2080, 2109, 2112, 2115, and 2147.

2148 (AECL-5121, pp 14-16) MEASUREMENTS OF g-FACTORS OF ISOMERIC LEVELS IN ^{211}At. McDonald, A. B.; Beene, J. R.; Haeusser, O.; Alexander, T. K.; Earle, E. D. May 1975.

In Physics Division progress report, 1 January–31 March 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

2149 (AECL-5121, pp 16-18) HALF-LIVES AND g-FACTORS IN POLONIUM ISOTOPES. Haeusser, O.; McDonald, A. B.; Alexander, T. K.; Beene, J. R.; Earle, E. D. May 1975.

In Physics Division progress report, 1 January–31 March 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

2150 (JINR–P6-8929) β DECAY OF NEUTRON-DEFICIENT ISOTOPES OF ^{207}Rn ($T_{\frac{1}{2}}$ = 10 min), ^{206}Rn ($T_{\frac{1}{2}}$ = 5.7 min) AND ^{205}Rn ($T_{\frac{1}{2}}$ = 2.8 min). Zelinski, A.; Zuber, K.; Zuber, Ya.; Kuznetsov, V. V.; Kolachkovski, A.; Lyatushinski, A.; Norseev, Yu. V.; Ortlepp, Kh. G.; Penev, I.; Potempa, A. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The decay of short-lived isotopes ^{207}Rn, ^{206}Rn and ^{205}Rn has been studied. The decay schemes of these nuclei are suggested. (4 figures, 3 tables) (auth)

2151 (NEANDC(E)-163U, pp 121-130) NEUTRON WIDTHS FOR ^{236}U FROM HIGH RESOLUTION TRANSMISSION MEASUREMENTS AT A 100 m FLIGHTPATH. Carraro, G.; Brusegan, A. (EURATOM, Geel, Belg.). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

A series of neutron transmission measurements has been performed on ^{236}U aiming at a determination of the resonance parameters and their statistical properties. The analysis range covered neutron energies from 40 eV to 4.1 keV. The experiments were carried out at the approximately 100 m flightpath of the 80 MeV electron linear accelerator of CBNM using a ^{10}B slab-NaI detector and 2 ^{236}U-oxide samples on loan from the USAEC. Table 2 displays the details of 6 experimental runs, 3 of which were arranged in such a way that the effect of the ^{235}U and ^{233}U impurities in the sample on the transmission was automatically compensated. For this, samples were put into the "open beam" position of the sample changer: they contained the same specific quantities of the impurities as in the ^{236}U-samples. Sample changer operation, data acquisition and storage were controlled by an IBM 1800 computer. The background was determined with the "black resonance" method. (3 tables) (auth)

2152 PROBING THE DEUTERON WAVE FUNCTION WITH SUB-COULOMB (*d,p*) REACTIONS. Knutson, L.D.; Haeberli, W. (University of Wisconsin, Madison, Wisconsin 53706). Phys. Rev. Lett. 35: No. 9, 558-561 (1 Sept 1975).

A new method is proposed to obtain information about η, the asymptotic *D*-state-to-*S*-state ratio for the deuteron. The method is based on the fact that polarized-beam measurements for sub-Coulomb (*d,p*) reactions are sensitive to the deuteron *D* state. (auth)

2153 NUCLEAR SPECTROSCOPIC INVESTIGATIONS CONCERNING THE STRUCTURE OF THE TRANSITION NUCLEUS ^{219}Rn. Richter, B. Bonn; Bonn Univ. (1973). 89p. (In German). INIS.

Thesis.

The central point of interest is the development of a method to measure the lifetimes of excited nuclear states after the α-decay. These are in the pico seconds region. Further on the α-γ-direction and linear polarization correlation coefficients are measured for three transitions in ^{219}Rn and interpreted in the framework of the Nilsson model. (auth)

2154 EFFECTIVE PARTICLE–PARTICLE AND HOLE–HOLE INTERACTION FOR NUCLEI NEAR THE LEAD REGION. Gaul, R. Hanover; Technische Univ. (1974). 81p. (In German). INIS.

Thesis.

The nuclear structures of nuclei in the ^{208}Pb region are calculated by the particle-hole model. In this model, the interaction potential is assumed as a modified Wood-Saxon potential and is applied to the Migdal theory for nuclei as Fermi liquid. Central forces and spin-orbit forces are calculated for the individual nuclei near ^{208}Pb and are compared with the experiments. (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 135, 1821, 2070, and 2080.

2155 (INIS-mf-1698, pp 3-12) MEASURING RATIOS OF THE U^{238} AND U^{235} FISSION CROSS SECTIONS BY 1.4 TO 7.4 MeV NEUTRONS. Fursov, B. I.; Kupriyanov, V. M.; Maslennikov, B. K.; Smirenkin, G. N.; Surin, V. M. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

This study presents the results of measuring the fission cross-section ratios of U-238 and U-235 over the neutron energy range of 1.4 to 7.4 MeV. The reactions T(p,n) He-3 and D(d,n) He-3 carried out on electrostatic accelerators served as neutron sources. An ionization chamber was used as a fission product detector. The overall accuracy of the results is about 2.5%. (tr-SJR)

2156 (INIS-mf-1698, pp 18-20) MEASUREMENT OF THE U-235 FISSION CROSS SECTION BY 2.5 MeV NEUTRONS WITH THE AID OF ACCOMPANYING PARTICLES METHOD. Fyuks, I. M.; Razumovskii, L. A.; Selitskii, Yu. A.; Fomichev, A. V.; Funshtein, V. B.; Shpakov, V. I. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Measurements were made of the fission cross-section of U-235 by 2.5 MeV neutrons. The reaction D(d,n) He-3 served as a neu-

tron source. The neutron flux irradiating the U-235 target was determined by counting the helium ions with a proportional counter. A value of 1.31 ± 0.05 barns was obtained for the cross-section. (tr-SJR)

2157 (INIS-mf-1698, pp 42-48) MEASURING ALPHA RATIO FOR PLUTONIUM-239 IN THE ENERGY RANGE 3 TO 200 keV. Vorotnikov, P. E.; Vukolov, V. A.; Koltypin, E. A.; Molchanov, Yu. D.; Yan'kov, G. B. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A measurement was made of the energy dependence of the ratio of the capture cross section to the fission cross section for plutonium-239 in the region of neutron energies from 3 to 200 keV. The work was performed on a pulse electrostatic accelerator. Neutron energy was determined by a time-of-flight method. The capture gamma rays, and also fission gamma rays and fission neutrons were counted by stilbene detectors. The results are presented in tabular form. (tr-auth)

2158 (INIS-mf-1698, pp 57-62) ENERGY SPECTRA AND MEAN VALUE $\bar{\nu}$ OF PROMPT NEUTRONS OF THE CURIUM ISOTOPE FISSION. Zhuravlev, K. D.; Zamyatnin, Yu. S.; Kroshkin, N. I. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Results are presented on measurement of the average number $\bar{\nu}$ and the spectra of prompt fission neutrons from curium isotopes. The average spectral energies $\bar{E}$ during spontaneous fission of Cm-244, Cm-246, Cm-248 and the fission of Cm-243, Cm-245 and Cm-247 by thermal neutrons were found to be respectively 2.07 ± 0.05, 2.09 ± 0.06, 2.15 ± 0.06, 2.15 ± 0.06, 2.25 ± 0.08, and 2.20 ± 0.06 MeV. The average number $\bar{\nu}$ of neutrons from these nuclei were respectively: 2.680 ± 0.027, 2.927 ± 0.027, 3.173 ± 0.022, 3.39 ± 0.14, 3.80 ± 0.16 and 3.79 ± 0.15. The dependence of $\bar{E}$ and $\bar{\nu}$ as a function of various parameters of the fissioning nucleus is discussed. (tr-SJR)

2159 (INIS-mf-1698, pp 63-69) MEAN VALUE OF PROMPT NEUTRONS FROM THE ^{235}U FISSION BY 0.2 TO 1.0 MeV NEUTRONS. Savin, M. V.; Khokhlov, Yu. A.; Ludin, V. N. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Results are presented on measurements of $\bar{\nu}$ during fission of U-235 by neutrons having energies of 0.2 to 1.0 MeV. Measurements were carried out on a linear electron accelerator. Selection of primary neutrons was made by a time-of-flight method. In order to count fission events, use was made of a multi-layer fission chamber which operated in the current mode. Fission neutrons were counted by a liquid scintillation detector. The measurement results are compared with data obtained earlier by the authors and with the results of other investigators. (tr-SJR).

2160 (INIS-mf-1698, pp 155-162) EMISSION PERIODS AND ENERGY SPECTRA OF DELAYED NEUTRONS OF THE ^{252}Cf SPONTANEOUS FISSION. Nefedov, V. N.; Starostov, B. I.; Potamanov, V. I. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

A method is described for measuring energies, periods of emission and yields of delayed neutrons. The energies of delayed neutron groups are estimated respectively as 100 ± 40 keV and 220 ± 40 keV with halflives of 123 nsec and 27.2 nsec, and yields of 0.4 ± 0.2% and 0.25 ± 0.15%. (tr-SJR)

2161 (INIS-mf-1698, pp 163-170) NATURE OF THE ^{252}Cf FISSION NEUTRON SPECTRUM EXCESS OVER MAXWELL DISTRIBUTION IN THE NEUTRON ENERGY RANGE BELOW 0.5 MeV. Nefedov, V. N.; Starostov, B. I. 1974. (In Russian).

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

The spontaneous neutron fission spectrum was measured in the region of energies below 0.5 MeV by a time-of-flight method for various time-of-flight distances with the use of a ^{6}LiI (Eu) neutron detector and a gaseous scintillation counter for fission products. It is pointed out that the nature of the deviation from a Maxwellian form of the Cf-252 neutron spectrum is caused by the existence of delayed fission neutrons. (tr-SJR)

2162 (INIS-mf-1698, pp 177-189) MEASUREMENTS OF THE NEUTRON ENERGY SPECTRUM OF THE SPONTANEOUS FISSION OF ^{252}Cf. Knitter, H. H.; Paulsen, A.; Liskien, H. 1974.

From 2nd all-union conference on neutron physics; Obninsk, USSR (3 Mar 1974).

In neutron physics. Part 4. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.).

Measurements were carried out on neutron energy spectra from the spontaneous fission of Cf-252 in the interval of 0.15 to 15 MeV according to the time-of-flight method. The form of the spectra agrees well with a Maxwellian distribution within the limits of the experimental error. (tr-SJR)

2163 (LA--6021-MS) GAMMA AND BETA DECAY POWER FOLLOWING ^{235}U AND ^{239}Pu FISSION BURSTS. England, T. R.; Schenter, R. E.; Whittemore, N. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1975. Contract W-7405-ENG-36. 12p. Dep. NTIS $4.00.

The total gamma and beta energy release rates following a fission burst are reported from using ENDF/B-IV data in summation calculations. Results are given for fission at neutron spectrum energies of ^{235}U and ^{239}Pu between 10^{-1} and 7×10^{5} s following bursts. Fallout decay power, obtained by subtractions of the gas contribution, is reported for the same interval. (auth)

2164 (NEANDC(E)-163U) SPECIALISTS MEETING ON RESONANCE PARAMETERS OF FERTILE NUCLEI AND ^{239}Pu, SACLAY, FRANCE, 20-22 MAY 1974. Ribon, P. (Ed.). (Nuclear Energy Agency, 75 - Paris (France). Nuclear Data Committee). Jan 1975. 315p. (CONF-740526-).

Separate abstracts have been prepared for the 18 papers included in the proceedings. (SDF)

For abstracts of individual papers see: 2070, 2151, 2165-2177, 2331, 2456, and 2457.

2165 (NEANDC(E)-163U, pp 73-112) EVALUATION OF ^{232}Th RESONANCE PARAMETERS. Derrien, H. (CEN, Saclay, France). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

In the last few years important work has been undertaken on ^{232}Th resonance parameters. The results achieved both for the individual values and the average values are frequently in disagreement. The main purpose of this work is to examine the most significant results and to propose a set of resonance parameters which seems more credible. The following topics are discussed: evaluation of resonance parameters and of their average values; cross sections in the thermal range and negative resonances; calculation of the capture cross section by a statistical model and comparison with the measured values; and evaluation of the capture integral from differential data and comparison with the integral measurements. (auth)

2166 (NEANDC(E)-163U, pp 113-120) COMMENTS ON ^{232}Th ABSORPTION RESONANCE INTEGRAL, $\langle\Gamma\gamma\rangle$, AND NEUTRON WIDTH STATISTICS. Ottewitte, E. H. (Federal Institute for Reactor Research, Wuerenlingen, Switzerland). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

A coarse review of the ^{232}Th resonance parameters has been made. Results are tabulated. (SDF)

2167 (NEANDC(E)-163U, pp 131-144) NEUTRON CROSS SECTION MEASUREMENTS ON ^{236}U BELOW 2 keV. Mewissen, L. (SCK/CEN, Mol, Belg.); Poortmans, F.; Rohr, G.; Weigmann, H.; Theobald, J. P.; Vanpraet, G. Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

Experimental details and results of analyses of scattering, capture and transmission experiments for neutrons incident on

^{236}U are discussed. Resonance parameters are tabulated. (4 figures, 2 tables) (SDF)

2168 (NEANDC(E)-163U, pp 145-148) RESONANCE SCATTERING CROSS SECTION OF ^{238}U BELOW 220 eV. Ceulemans, H. (SCK/CEN, Mol, Belg.). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

Results of a pilot-scale scattering experiment on ^{238}U are presented. It is shown that with thin samples reliable values for Γ_n can be obtained. In favorable cases it should be possible to combine information from scattering and transmission experiments to obtain an independent determination of Γ_γ. (1 table) (auth)

2169 (NEANDC(E)-163U, pp 149-158) NEUTRON SCATTERING CROSS SECTION MEASUREMENTS ON ^{238}U IN THE RESOLVED ENERGY RANGE. Poortmans, F. (SCK/CEN, Mol, Belg.); Mewissen, L.; Rohr, J.; Weigmann, H.; Vanpraet, G. Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

Scattering cross section measurements have been performed on ^{238}U below 1 keV. A part of the data has been analyzed and the results are compared with previous measurements. (6 figures, 1 table) (auth)

2170 (NEANDC(E)-163U, pp 159-182) EVALUATION OF ^{238}U RESONANCE PARAMETERS. Moxon, M. C. (Atomic Energy Research Establishment, Harwell, Eng.). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

Individual resonance parameters are required in calculations of the self-screening, multiple scattering, and Doppler effects for fast reactors. A list of available resonance data is given and weighted mean values for all parameters have been calculated using all of the published data. Chi-squared checks were used to test individual references and it is concluded that the weighted mean values are probably the best values available at present. (3 figures, 6 tables) (SDF)

2171 (NEANDC(E)-163U, pp 183-190) SOME COMMENTS ON THE EVALUATION OF THE UNRESOLVED RESONANCE PARAMETERS OF ^{238}U. Sowerby, M. G. (Atomic Energy Research Establishment, Harwell, Eng.). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

Evaluations of unresolved resonance parameters are required so that good calculations can be made of self shielding factors, the doppler temperature coefficient of reactivity and other reactor parameters which depend on resonance structure. The aim of these evaluations is to enable a set of resonances to be generated which have a similar distribution of properties as the resonances actually present. The generation of these resonances is done using various computer programs and the formalisms used and assumptions made in these may be slightly different. No attempt has been made to investigate this problem but there are probably no great inconsistencies. However, because of possible differences one should take care in drawing detailed conclusions from comparisons of unresolved parameters. (5 tables) (auth)

2172 (NEANDC(E)-163U, pp 191-202) PRELIMINARY RESULTS OF A SHAPE MEASUREMENT OF THE ^{238}U CAPTURE CROSS SECTION IN THE NEUTRON ENERGY RANGE 20 TO 600 keV. Spencer, R. R.; Kaeppeler, F. (Kernforschungszentrum, Karlsruhe, Ger.). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

The lack of agreement in the value and shape of the neutron capture cross section of ^{238}U below 100 keV obtained in three recent high resolution time-of-flight measurements suggests that further measurements of this important cross section may be of value. The present measurement will be carried out in three separate stages. In the first stage, the results of which are reported, a shape measurement was made with the 800 liter liquid scintillator tank in the neutron energy region from 20-550 keV relative to the ^{235}U fission cross section. As an independent check a simultaneous measurement of the ^{197}Au[n,γ] yield was made. The second stage will consist of the calibration of a Moxon-Rae detector using a pulsed, monoenergetic neutron beam of 17 meV energy at the Karlsruhe, FR 2 Reactor, and capture samples of both gold and ^{238}U. Due to possible difficulties with the small amount of ^{235}U with relatively large fission cross section in the ^{238}U sample, the gold measurement may be essential. In the final stage several measurements in the keV neutron energy region will be performed at the pulsed Van de Graaff with this calibrated system using the same samples as in stage two. The ^{235}U fission detector will be used as a neutron monitor for the last two stages also. This then will provide the "absolute" capture cross section to be used as a reference for the shape measurement. (auth)

2173 (NEANDC(E)-163U, pp 203-217) RECENT MEASUREMENTS ON ^{238}U AT ORNL. de Saussure, G. (Oak Ridge National Lab., TN). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

Three sets of measurements of the capture cross section of ^{238}U in the range 5 eV to 100 keV have been compared and show systematic discrepancies. To resolve this problem, another series of measurements has been undertaken. The experimental technique for this latest measurement is described and some of the earlier data is discussed. (10 figures) (SDF)

2174 (NEANDC(E)-163U, pp 219-241) EVALUATION OF ^{240}Pu RESONANCE PARAMETERS. Weigmann, H. (EURATOM, Geel, Belg.); Rohr, G.; Poortmans, F. Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

The status of data on ^{240}Pu resonance parameters is reviewed. Some statistical tests are performed on the data and recommendations are given, particularly with respect to the average parameters. (1 figure, 3 tables) (auth)

2175 (NEANDC(E)-163U, pp 243-262) PLUTONIUM-239 RESONANCE PARAMETERS. Derrien, H. (CEN, Saclay, France). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

A set of parameters have been examined that may be used for calculating Pu 239 cross sections from 4 eV to 660 eV by the single level formalism. The Saclay multi-level parameter set has been proposed between 4 eV and 205 eV in the case it should be found necessary to allow for the interferences in wide resonances. Evaluated resonance parameters are tabulated. (6 tables) (auth)

2176 (NEANDC(E)-163U, pp 263-290) MULTILEVEL BREIT-WIGNER FORMALISM WITH DOPPLER BROADENING APPLIED TO THE ^{239}Pu RESONANCES. Menapace, E.; Motta, M. Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

The Breit-Wigner single level (SL) and multilevel (ML) formulas for representing resolved resonances are discussed. Some results of the application of the ML formalism to the multilevel R matrix parameters of ^{239}Pu are described. (SDF)

2177 (NEANDC(E)-163U, pp 297-314) LOW-ENERGY NEUTRON INDUCED FISSION CROSS SECTION OF ^{239}Pu AND THE TEMPERATURE DEPENDENCE OF THE WESTCOTT g_f FACTOR. Wagemans, C.; Deruytter, A. J. (SCK/CEN, Mol, Belg.). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

The relative neutron induced fission cross section was determined for ^{239}Pu in the region .01 to 30 eV. The most important

cross section measurements in this range are considered and origins of the discrepancies are discussed. A calculation is made of the Westcott g_f factor as a function of the temperature of the Maxwellian neutron distribution. (6 tables, 4 figures) (SDF)

2178 COULOMB EXCITATION OF HIGH-SPIN STATES IN ^{238}U. Gross, E.; de Boer, J.; Diamond, R.M.; Stephens, F.S.; Tjøm, P. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). Phys. Rev. Lett. 35: No. 9, 565-568 (1 Sept 1975).

Coulomb excitation with Kr and Xe ions has excited the ground-state band of ^{238}U up to the 22^+ (tentatively 24^+) state and the lowest octupole vibrational band up to 19^-. No backbending is observed. The behavior of the octupole band at high spins suggests a Coriolis-induced alignment of the rotational and vibrational angular momenta. (auth)

2179 ^{238}U AND ^{232}Th PHOTOFISSION AND PHOTONEUTRON EMISSION NEAR THRESHOLD. Dickey, P.A.; Axel, P. (Department of Physics, University of Illinois at Urbana-Champaign, Illinois 61801). Phys. Rev. Lett. 35: No. 8, 501-504 (25 Aug 1975).

Variable-energy photons defined to 100 keV were used to study ^{238}U and ^{232}Th from 5 to 8 MeV. The inferred fission transmission indicates (a) that the lowest 1^- fission barrier is about 6.5 MeV in ^{238}U and 6.3 MeV in ^{232}Th, and (b) that there is an energy gap before the rapid opening of additional fission channels above 7 MeV in ^{238}U. (auth)

2180 POSSIBILITY OF EXPERIMENTAL CHECK OF THE HYPOTHESIS ON SHAPE ISOMERISM OF HEAVY NUCLEI. Grechukhin, D. P. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 21: No. 5, 956-963(May 1975). (In Russian)

Possible ways of direct experimental check of the hypothesis on the shape isomerism of heavy nuclei are considered. The existing data on the isotopic shift of optical lines of the americium atom are used to estimate the expected value of the isomeric shift of the analogue lines of the ^{242m}Am atom provided there exists the shape isomerism of the nucleus ^{243}Am with a deformation value β(SFI) = 0.6. For a number of lines the expected shift is about 20 cm^{-1}, therefore observation of the isomeric shift of lines in the optical range can be a decisive experiment on the check of the shape isomerism hypothesis. The mean square radius of the charge distribution and the quadrupole electric moment of a strongly deformed nucleus are calculated for some realistic shapes of the nuclear surface. (2 figures, 2 tables) (auth)

2181 RATIO OF THE URANIUM-238 TO URANIUM-235 FISSION CROSS SECTIONS FROM 5.3 TO 10.3 MeV. Meadows, J. W. (Argonne National Lab., IL). Nucl. Sci. Eng.; 58: No. 2, 255-257(Oct 1975).

The ^{238}U-to-^{235}U fission cross-section ratios were measured for neutron energies from 5.33 to 10.32 MeV at intervals of approximately 0.25 MeV. The estimated errors in the ratio values are 1.5 to 2 percent. (auth)

2182 BINARY AND TERNARY FISSION YIELDS INDUCED BY ^{12}C AND ^{20}Ne IONS ON ^{238}U TARGETS. Otto, R. J. Lafayette, IN; Purdue Univ. (1974). 181p. University Microfilms Order No. 75-17,263.

Thesis (Ph. D.).

Evidence for ternary fission of ^{250}Cf* and ^{258}No* compound nuclei has been found. Relative cross section data for nuclides with masses between ^{24}Na and ^{161}Tb have been determined for ^{12}C bombardments of natural uranium at laboratory energies of 122 MeV, 113 MeV and 105 MeV. Relative cross section data for 8 nuclides between ^{24}Na and ^{66}Ni were sought for ^{20}Ne bombardments of natural uranium at 150 MeV laboratory energies. The binary fission fragment mass distribution for ^{238}U(^{12}C,f) was determined by analysis of fission fragment recoil collection foils using radiochemical techniques and high resolution gamma ray spectroscopy. The results indicated the existence of a ternary fission branch similar to mass distributions obtained for He induced fission of Th, U, and Pu nuclei at intermediate energies. Comparison of the data with He induced ternary fission data obtained previously in this laboratory indicated an increase in the ternary fission probability with increasing Z^2/A of the compound nucleus and with excitation energy. A shift of the binary-ternary fission product intersection point to lower mass numbers with increasing Z^2/A and excitation energy of the compound nucleus was also observed. (Diss. Abstr. Int., B)

Nuclear Theory

Refer also to abstracts 1581, 2086, 2120, 2152, and 2180.

2183 (CONF-750935-11) COMPARISON OF DIFFERENTIAL AND INTEGRAL CROSS SECTION MEASUREMENTS. Greenwood, L. R.; Heinrich, R. R.; Dudey, N. D. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 11p. Dep. NTIS $4.00.

From first ASTM-Euratom symposium on reactor dosimetry; developments and standardization; Petten, Netherlands (22 Sep 1975).

A program has been undertaken to simultaneously measure integral and differential cross sections in order to establish the degree of consistency between integral and differentially derived spectra. An assessment is then made concerning cross section limitations in deriving high energy neutron spectra by the foil-activation spectral-unfolding technique. (SDF)

2184 (COO-2458-5) DIRECT DATA ADJUSTMENT FOR ^{238}U. Parvez, A.; Becker, M. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA). Dept. of Nuclear Engineering). 1975. Contract AT(11-1)-2458. 5p. (CONF-751101-3). Dep. NTIS $4.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

Continuous slowing down theory, generalized to incorporate the effect of inelastic scattering, is being used as an aid in interpreting discrepancies between calculated and measured fast neutron spectra. The process uses an interactive graphics system (MODIN) permitting adjustment directly on nuclear data. A brief description of the system is given. (SDF)

2185 (HEDL-SA-787) BENCHMARK EXPERIMENTS FOR FISSION PRODUCT DATA (NUCLEAR DATE). Schenter, R. E. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1975. Contract E(45-1)-2170. 6p. (CONF-750303-75). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Five general areas of application for nuclear cross sections have been identified for benchmark testing by the Cross Section Evaluation Working Group (CSEWG); thermal and fast reactors, shielding, dosimetry and fission product properties. For both thermal and fast reactors, benchmark experiments consist of measurements of integral reaction rates, reactivity coefficients and criticality in well defined, simple geometry, uniform composition assemblies. Thermal reactor benchmark experiments are carried out in spheres of heavy metal nitrate solutions and in H_2O and D_2O moderated lattices of uranium. Carefully specified experiments in large, fast, Zero-Power critical assemblies (e.g., ZPR-6-7, ZPPR-2) and in small uranium and plutonium metal spheres (e.g., Godiva, Jezebel) provide integral tests primarily for uranium and plutonium capture and fission cross sections and fission neutron properties in the energy range 0.1 keV to 10 MeV. Shielding benchmark experiments are characterized by a well defined neutron source, detectors having known absolute response functions and a simple source-detector geometry. Dosimetry benchmark experiments consist of integral reaction rate measurements in known neutron spectra. These experiments include measurements sensitive to low energy neutrons (e.g., ^{10}B(n,alpha), ^{197}Au(n,gamma) in thermal spectra) and to relatively high energy neutrons (e.g., ^{238}U(n,f), ^{239}Pu(n,f) in fission spectra). Benchmark experiments for fission products include integral measurements of capture rates and reactivity effects for individual fission product isotopes in typical reactor spectra (e.g., the CFRMF and STEK facilities) and measurements of fission product yields and decay properties, especially those decay modes relating to decay heat production. The results of all these benchmark experiments have been compared to calculations using the latest version of the Evaluated Neutron Data File, ENDF/B-IV. (auth)

2186 (JINR-P4-9054) SINGLE PARTICLE QUASI-STATIONARY STATES OF SPHERICAL AND DEFORMED NUCLEI. Bank, E.; Gareev, F. A.; Puzynin, I. V.; Yamaleev, R. M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab of Theoretical Physics). 1975. 30p. Dep. NTIS (US Sales Only) $4.50.

A method is presented for investigation of single-particle quasi-stationary states of spherical and deformed nuclei in a subbarrier energy region. The wave functions and the energy levels of quasi-stationary states are found as eigensolutions of the Schroedinger equation using a continuous analog of the Newton method. (5 tables, 6 figures) (auth)

2187 (JINR-P4-9081) CALCULATION OF SINGLE-PARTICLE STATES OF DEFORMED NUCLEI IN THE SAXON-WOODS POTENTIAL. Ivanova, S. P.; Shirikova, N. Yu. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 24p. Dep. NTIS (US Sales Only) $4.25.

A brief description is presented for the method of calculation of single-particle states of deformed nuclei in the Saxon-Woods potential. The base calculation formulae, short program characteristics (written in the FORTRAN language) as well as the de-

scription of their input data have been presented. (2 figures) (auth)

2188 (JUL-1187) RESONANCES IN THE POTENTIAL SCATTERING AND DECAY OF METASTABLE STATES. Batsch, J. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Festkoerperforschung). Apr 1975. 145p. (In German). Dep. NTIS (US Sales Only) $10.25.

Thesis. Submitted to Technische Hochschule, Aachen.

The analytic properties of the S-matrix in the complex energy plane are reviewed for potential scattering with particular attention to resonance scattering and decay of metastable states. For a one dimensional model potential with a potential barrier and a repulsive core exact formulas are derived for the energy and width of a resonance in terms of the scattering amplitudes of the barrier and the repulsive core alone. For narrow resonances simple and intuitive results are obtained, which are applied to semiclassical cases where the WKB approximation is valid. (37 figures) (auth)

2189 (LA-UR-75-1575) OPTICAL MODEL POTENTIALS FOR DEUTERONS, TRITONS, AND HELIONS. Keaton, P. W. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 16p. (CONF-750829-2). Dep. NTIS $4.00.

From fourth international symposium on polarization phenomena in nuclear reactions; Zurich, Switzerland (25 Aug 1975).

The folding model is thoroughly reviewed with a view toward explaining polarization data in deuteron elastic scattering experiments. The discussion is then extended to the scattering mechanism for spin interactions of tritons and helions with heavy and intermediate mass nuclei. In both cases, phenomenological potentials are examined and examples are cited. (8 figures, 1 table, 84 references) (SDF)

2190 DAMPING OF ISOBARIC ANALOG RESONANCES. Urin, M.G. (Moscow Engineering and Technical Institute). JETP Lett. 21: No. 8, 234-235 (20 Apr 1975).

A formula that takes into account the connection between the proton channels of the decay of isobaric analog resonances (IAR) is obtained for the width of the "breakup" of the IAR on a configuration of complicated character as a result of the mechanism of "external" Coulomb mixing. (auth)

2191 ISOSPIN MIXING IN NUCLEAR LEVELS. Barker, F.C. (Research School of Physical Sciences, The Australian National University, Canberra, ACT.2600, Australia). Phys. Rev. Lett. 35: No. 9, 613-614 (1 Sept 1975).

Alternative formulations used in the description of isospin mixing in nuclear levels are discussed. (auth)

2192 MICROSCOPIC DESCRIPTION OF VARIATION OF THE COLLECTIVE PARAMETERS OF EVEN-EVEN NUCLEI AT ROTATION. Karadzhov, D.; Mikhailov, I. N.; Piperova, J. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 5, 964-976(May 1975). (In Russian)

A microscopic model of the induced rotation type model is presented to describe the states in the ground rotation band for deformed even-even nuclei. In framework of this model the equations are constructed and solved numerically that determine the spin dependence of the parameters of quadrupole deformation and pairing. Comparison of the theoretical estimates with known experimental data shows an applicability of the presented scheme to describe nonadiabatic corrections to the matrix elements of multipole operators at not too high spin values. (2 tables) (auth)

2193 SOME GROUP-THEORY ASPECTS OF THE METHOD OF GENERALIZED HYPERSPHERICAL FUNCTIONS. Asherova, R. M.; Knyr, V. A.; Smirnov, Yu. F.; Tolstoi, V. N. (Moscow State Univ.). Yadern. Fiz.; 21: No. 5, 1126-1134(May 1975). (In Russian)

The relation of the GHF method to the shell model invariant under translation is considered. It is shown that the calculations in the ground approximation of the GHF method are equivalent to the diagonalization of the nuclear Hamiltonian in the space of an infinite irreducible representation of a noncompact group of canonical transformations Sp(6, R). Discovery of the relation between the two approaches makes it possible to predict the results of calculations in the framework of the GHF method. (1 table) (auth)

2194 RECONSTRUCTION OF THE INTERACTION POTENTIAL FOR TWO α PARTICLES FROM THE EXPERIMENTAL DATA AT FIXED ORBITAL MOMENTUM. Malyarov, V. V.; Poplavskii, I. V.; Popushoi, M. N. (Odessa Engineering-Construction Inst.). Yadern. Fiz.; 21: No. 5, 987-991(May 1975). (In Russian)

Reconstruction is considered of the two-α-particle interaction potential from the scattering function constructed based on the values of nuclear phase shift, characterizing the α-particle scattering on ^{4}He and known from the phase shift analysis. The numerical calculation of the potential is carried out at fixed value of the orbital momentum l (l = 0, 2, 4, 6) with no account of the absorption. (3 figures) (auth)

2195 PRE-EQUILIBRIUM DECAY OF NUCLEI IN PHOTONUCLEAR REACTIONS. Luk'yanov, V. K.; Seliverstov, V. A.; Toneev, V. D. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 5, 992-1000(May 1975). (In Russian)

It is shown that an important role is played by coherent excitation of levels of the giant dipole resonance in pre-equilibrium decay of nuclei in photonuclear reactions. (3 figures) (auth)

2196 $Z^{1/3}$-LAW FOR THE NUCLEAR CHARGE RADIUS. Tseng, C. Y. (Peking Univ.). Wu Li Hsueh Pao; 24: No. 2, 151-162(Mar 1975). (In Chinese).

The nuclear charge distribution radius determined by muon x-ray and electron scattering experiments in recent years is investigated. Analysis of more than 70 experimental data of nuclear charge radii show that they deviate systematically from the $A^{1/3}$ law that has been conventionally used in international literatures, but abide quite well to the $Z^{1/3}$ law, or $R_p = r_{0p}Z^{1/3}$, where $r_{0p} \approx 1.64$ fm. A discussion is also made on the rules of isotope and isotone nuclear charge radii variations. According to the $Z^{1/3}$ law, the difference of nuclear coulomb energy changes Δ is found to be approximately proportional to $Z^{1/3}$, which coincides with experiments. (auth)

2197 DISPERSION K-MATRIX APPROACH TO αt SCATTERING AND DETERMINATION OF THE VERTEX CONSTANT FOR THE PROCESS α REVERSIBLE t + p. Baryshnikow, A. G.; Blokhintsev, L. D. (Moscow State Univ.). J. Phys., G (London); 1: No. 6, L43-L47(1 Aug 1975).

It is assumed that the main contribution to the reaction K matrix for elastic αt scattering comes from the pole Feynman graph corresponding to the proton transfer mechanism. The differential cross section calculated under this assumption furnishes a satisfactory description of the experiment and allows one to obtain the value 10.0 fm for the vertex constant $G^2_{\alpha tp}$ of the process $\alpha \rightleftharpoons$ t + p. Taking account of the infinite series of graphs describing the multiple proton exchange improves agreement with the experiment and leads to $G^2_{\alpha tp} = 12.2$ fm. (auth)

2198 EXISTENCE OF A COMPLEX AND NONLOCAL α-NUCLEUS POTENTIAL AND THE α-DECAY. Carstoiu, F.; Dumitrescu, O.; Popescu, D. G. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 4, 415-420(1975).

A rigorous explanation of necessity to introduce nonlocal and complex effective residual interaction in the α-nucleus Hamiltonian when working with the usual shell model wave functions, is given. (auth)

2199 CONCERNING THE DISPERSION THEORETICAL TREATMENT OF DIRECT REACTIONS. Beisenherz, H. G. Munich; Technische Univ. (1974). 136p. (In German). INIS.

Thesis.

Dispersion theoretical treatment methods for direct reactions according to a generalized Omnes method are discussed. These are compared with other expressions for the scattering amplitudes. Furthermore, it is shown that it is physically an advantage in direct reactions to use dispersion relations instead of DWBA. (GE)

2200 NEUTRON INDUCED FISSION IN ISOMERIC NUCLEI. Mueller, R. Tuebingen, Ger.; Tuebingen Univ. (1973). 43p. (In German). INIS.

Thesis.

The excitation of isomeric states was obtained by the capture of fast neutrons. The isomeric states are referred via delayed fission. ^{234,235,238}U and ^{239}Pu are used as targets. Due to measurements with charged particles isomers are to be expected only for the target nuclei ^{235}U and ^{239}Pu. The measured half-lives were 130 ns for the U-isomer and 4 ns for the Pu-isomer. A measurement of the ratio of isomeric and prompt fission makes it possible to get the parameter of the double-bumped potential. The higher of the two barriers is determinable so as the energy difference between them. (auth)

2201 CONCERNING THE TREATMENT OF ROTATIONAL BANDS, MOMENTS OF INERTIA, AND TRANSITION PROBABILITIES OF DEFORMED NUCLEI. Reinecke, M. Erlangen, Ger.; Erlangen-Nuernberg Univ. (1973). 189p. (In German). INIS.

Thesis.

The stationary states of rotational bands of deformed odd-even, even-odd and odd-odd nuclei are investigated using the collective nuclear model. The problem of the effective moment of inertia of a collective rotational band was dealt with in particular. Futhermore, the multipole transitions within collective rotational bands

are investigated where the nuclei are described by a homogeneous charged spheroid. (auth)

2202 BINDING ENERGY FOR INHOMOGENEOUS NUCLEAR MATTER. Ludwig, S. Wuerzburg, Ger.; Wuerzburg Univ. (1973). 46p. INIS.

Thesis.

For a spatial finite nuclear density distribution a binding energy formula is developed. A modified Thomas Fermi method which deduces the mixed density by taking into account an anisotropic local momentum space occupation is used. This method presents the binding energy as a functional of the proton- and neutron-density distributions. It was possible within this framework to deduce in a consistent way the energy correction terms due to density inhomogeneities. The structure of the energy correction terms is shown, and an estimate is given for the adjustable parameters of this model to fit the experimental nuclear masses. (auth)

2203 EFFECTIVE ELECTROMAGNETIC OPERATORS IN LIGHT NUCLEI. Pintar, J. A. Lawrence, KS; Univ. of Kansas (1974). 132p. University Microfilms Order No. 75-6240.

Thesis (Ph. D.).

The effective operator method is used to calculate matrix elements of the magnetic dipole and electric quadrupole operator in the nuclear 1p shell. The calculational obstacles involved in obtaining the many-body model wavefunctions from an exact application of the effective interaction approach are bypassed by using eigenfunctions determined by a shell model phenomenological fit. The effective operators are assumed to be at most two-body. Realistic two-body (correlated) wavefunctions, which are generated by solving the Bethe-Goldstone equation using a modern nuclear potential, are used to determine the matrix elements of the operators. These are then combined with the appropriate angular momentum coefficients and the many-body wavefunctions, and the results compared with the experimental transition rates and moments throughout the shell. The absence of improvement over the results using the bare operators indicates that the effects of channel coupling and core exclusion are insufficient. A detailed analysis of the M1 data is carried out for the low-lying states in ^{14}N. Using an unmodified operator, the many-body wavefunctions are phenomenologically adjusted to reproduce the experimental results. In addition, an effective interaction is extracted from these wavefunctions. The definite inconsistencies between this analysis and previous shell model results of other authors indicate unequivocally that some alteration of the M1 operator is necessary. A two parameter phenomenological operator is constructed using the sum of the orbital g-factors as one of the adjustable parameters. The operator is fit to two pieces of data in ^{14}N. The moments and transition widths are recalculated, resulting in improved agreement with experiment throughout the shell. (Diss. Abstr. Int., B)

2204 PION–NUCLEUS ELASTIC SCATTERING. Phatak, S. C. Pittsburgh; Univ. of Pittsburgh (1974). 111p. University Microfilms Order No. 75-6376.

Thesis (Ph. D.).

A theoretical study of pion-nucleus elastic scattering in the 3-3 resonance region is presented. The optical model approach has been used to calculate reaction cross sections, differential cross sections, and pion optical wave functions for elastic scattering of pions from closed shell nuclei. The optical potential is obtained from a multiple scattering theory. The input is the off-shell piN scattering matrix and the nuclear form-factor. The multichannel separable model of Londergan, Moniz, and McVoy is used to calculate the off-shell pi N scattering matrix and the nuclear form-factors are obtained from Negele's calculations. A transformation of the pi N scattering matrix from the pi N C.M. to the pi-nucleus C.M. has been included. These calculations are performed in momentum space and the Coulomb interaction between the pion and the nucleus has been included. (Diss. Abstr. Int., B)

2205 INSTABILITIES OF MATTER IN STRONG EXTERNAL FIELDS AND AT HIGH DENSITY. Klein, A.; Rafelski, J. (Univ. of Pennsylvania, Philadelphia). pp 152-221 of Fundamental Theories in Physics. Mintz, S. L. (Ed.). New York; Plenum Publishing Corp. [nd].

In the recent literature, there have been a number of theoretical studies of new phenomena involving the instability of the ground state (sometimes called the vacuum state) of various fundamental forms of matter under unusual perturbations. One considers in detail two examples of instability under the application of Coulomb fields of superheavy nuclei, against the emission of positrons and the creation of a condensate of charged pion pairs. The former may occur for atomic number Z approximately 170, whereas the latter requires Z greater than 10^3. The theory of possible forms of pion condensation inside nuclear matter and neutron star matter is also discussed. By careful attention to fundamentals, an effort is made to clarify some of the controversy now raging in the literature concerning these speculations. (auth)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 734, 1802, 1873, and 2062.

2206 (AD/A-004514) INTERACTION OF SLOW PARTICLES WITH MATTER AND PLASMA DIAGNOSTICS. Gott, Yu. V.; Yavlinskii, Yu. N. 17 Dec 1974. Translation of Vzaimodeistvie Medlennykh Chastits s Veshchestvom i Diagnostika Plazmy, n.p., 1973. (FTD-HC-23-2174-74). 158p. NTIS $6.25.

The question of the interactions of slow particles (of energy less than 50 keV) with solids is considered in this book. The authors describe the current theoretical and experimental status of the investigations of the energy loss and range of particles in matter, proton charge exchange, and proton scattering in traversing a layer of matter. Experimental methods which are applicable to this type of research are described. Methods of obtaining very thin layers of material to study (without backing), which are used as targets, are discussed in detail. The last part is devoted to the application of the phenomena investigated to corpuscular diagnostics of laboratory and cosmic plasma. (GRA)

2207 (IEA-38) HEALTH PHYSICS. Poston, J. W. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Dec 1974. 120p. Dep. NTIS (US Sales Only) $9.00.

Eight lectures prepared for a training course in radiation protection for personnel are included. Topics discussed include: interaction of radiations with matter; radiation quantities and units; the physical basis of radiation dosimetry; the detection and measurement of radiation; dosimetry of mixed radiations; special methods in radiation dosimetry; the dosimetry of electrons and beta rays; and a brief review of radiation biology. (CH)

2208 (LA-6015-T) INVESTIGATION OF PATTERN RECOGNITION TECHNIQUES FOR THE IDENTIFICATION OF SPLITTING SURFACES IN MONTE CARLO PARTICLE TRANSPORT CALCULATIONS. Macdonald, J. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1975. Contract W-7405-ENG-36. 306p. Dep. NTIS $7.60.

Statistical and deterministic pattern recognition systems are designed to classify the state space of a Monte Carlo transport problem into importance regions. The surfaces separating the regions can be used for particle splitting and Russian roulette in state space in order to reduce the variance of the Monte Carlo tally. Computer experiments are performed to evaluate the performance of the technique using one and two dimensional Monte Carlo problems. Additional experiments are performed to determine the sensitivity of the technique to various pattern recognition and Monte Carlo problem dependent parameters. A system for applying the technique to a general purpose Monte Carlo code is described. An estimate of the computer time required by the technique is made in order to determine its effectiveness as a variance reduction device. It is recommended that the technique be further investigated in a general purpose Monte Carlo code. (auth)

2209 (RD/B/N-3274) DEFINITION OF A GENERAL ELECTRON PENETRATION PROBLEM FOR SOLUTION BY TRANSPORT THEORY. Johnson, D. M. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1975. 10p. Dep. NTIS (US Sales Only) $4.00.

The current status of electron transport calculations in the UK is very poor. In most cases crude approximations are made or the accurate results of a few specific calculations are applied generally. With constant effort for increased accuracy, particularly in the health physics field, this is no longer adequate and the sophisticated techniques of neutron and gamma transport methods must be applied. The penetration of electrons through matter has been defined, in a number of problems, as a significant effect where an accurate solution is desirable. This limits the versatility required of any technique and unnecessary complexity is avoided. Existing transport methods are briefly reviewed and the approaches that are being made are discussed. (auth)

2210 (TID-26607) PARTICLE-TRANSPORT SIMULATION WITH THE MONTE CARLO METHOD. Carter, L. L.; Cashwell, E. D. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. 123p. Dep. NTIS $5.45.

Attention is focused on the application of the Monte Carlo method to particle transport problems, with emphasis on neutron and photon transport. Topics covered include sampling methods, mathematical prescriptions for simulating particle transport, mechanics of simulating particle transport, neutron transport, and photon transport. A literature survey of 204 references is included. (GMT)

2211 STOPPING POWERS OF SEVERAL COMPOSITE MATERIALS FOR 2.4 AND 3.5 MeV DEUTERONS AND 5.5 MeV α PARTICLES. Shepard, C.L.; Porter, L.E. (University of Montana, Missoula, Montana 59801). Phys. Rev. B 12: No. 5, 1649-1657 (1 Sept 1975).

Stopping powers of the alloys Havar, Mu Metal, and Permalloy 4750 have been determined for 2.4- and 3.5-MeV deuterons. Similar measurements were made with foils of Havar, Mu Metal, Teflon, and Mylar for ^{241}Am α particles. Mean excitation energies extracted from the data were compared with values obtained from Bragg's rule. Whereas results for Havar, Mu Metal, and Teflon generally agree with additivity predictions, the experiment-based mean excitation energy of Mylar lies 10% above, and that of Permalloy 4750 6% below, the Bragg's-rule calculation. (auth)

2212 CONTRIBUTION TO THE RATIONALIZATION OF THE CALCULATION OF DISTRIBUTION DOSE IN TELECURIETHERAPY. II. Pendulum Technique. Matula, P.; Futas, E.; Klvana, M.; Kunstadt, E. Cesk. Radiol.; 28: No. 5, 336-342(Sep 1974). (In Czech).

The review describes the principle of calculation of dose distribution on the basis of the conception of constant focus distance SSD as well as respective corrections of geometric and physical parameters of the pendulum technique. There is further depicted the description of entry data into the computer, the analysis of the influence of changes of the shape of the patient and the angular difference of summated fields on the distribution of dose and on the exposition time. Possibilities of the standardization of calculation of the irradiation plans by means of a time factor defined by the authors as well as the possibilities of saving the machine time of computer by means of suitable election of angular difference of summated fields of the oscillatory motion as entry parameter are being discussed. (auth)

2213 CONVERSION OF BETA-RAY DOSE RATES MEASURED IN AIR TO DOSE RATES IN SKIN. Harvey, J. R.; Macfarlane, B. J.; Shipton, R. G.; Thompsons, I. M. G. (Central Electricity Generating Board, Berkeley, Eng.). Phys. Med. Biol.; 20: No. 4, 653-656(Jul 1975).

Experimental measurements of the contribution of backscattered beta radiation to the dose at a tissue surface gave results of interest in the assessment of the relationship between beta dose in free air and that in tissue at a tissue interface. Measurements were made using two independent techniques, one involving extrapolation ionization chambers and the other calcium sulphate thermoluminescent dosemeters. The measurements were made in contact with, and at 10 and 30 cm from plane ^{90}Sr-^{90}Y sources. A self-consistent set of values was obtained for the beta backscatter factors at three distances from various ^{90}Sr-^{90}Y sources with the two independent techniques. The backscatter factors increased as the measurement point approached the source, reaching values as high as 50% for contact with plane ^{90}Sr-^{90}Y sources. It is emphasized that the use of backscatter factors of around 10% could give rise to serious underestimation of dose in close proximity to plane beta sources of the type used in these investigations. (UK)

2214 DEPTH ABSORBED DOSE DISTRIBUTIONS FOR ELECTRONS. Atherton, L.; Coleman, F. J. (M.E.L. Equipment Co. Ltd., Crawley, Eng.). Phys. Med. Biol.; 20: No. 4, 658-661(Jul 1975).

Measurement of depth absorbed dose distributions have been made on an SL 75 linear accelerator using a 0·1 mm^3 active volume solid state detector (Scanditronix RFA 1) in a water phantom with a thin entrance window. The results are directly comparable with those given for various types of accelerator. These workers compared the electron beam from the microtron operating under conditions different from those of the MEL SL75 linear accelerator. The microtron beam with no foil scatterer produces a circular beam 14 cm in diameter with a fall-off of 50% at the periphery and would therefore appear to be of doubtful clinical value. It should not have been compared with the fully scattered and collimated SL75 beam. When measurements were taken under similar conditions the narrow energy spectrum, clean geometry and small amount of scattering material in the microtron electron beam were shown to produce beams which were not significantly different from those obtainable from linear accelerators. In addition, the contour plots for the normal clinical beam from an SL75 accelerator were shown to satisfy typical clinical requirements. (UK)

2215 SMALL-ANGLE SCATTERING OF INTERMEDIATE ELECTRONS IN THE PASSAGE THROUGH AMORPHOUS SOLID-

BODY LAYERS. Schwertfeger, W. Tuebingen, Ger.; Tuebingen Univ. (1974). 79p. (In German). INIS.

Thesis.

A method is given with which potentials and electron distributions, calculated for free atoms, can be approximately fitted to the relationships in the solid body. Differential and total scattering cross-sections for the elastic and inelastic scattering of 40, 60, 80, and 100 keV electrons from C, Ge, and Pt solid-state atoms are numerically calculated where Hartree-Fock-Slater functions according to Herman and Skillman are taken as basis for the electron distribution of the free atoms. The Schroedinger equation for the passage of an electron through an amorphous solid body layer is approximately solved. The region of validity of the multiple scattering formula according to Bothe, which represents a small-angle approximation, is investigated. Futhermore, a formula is derived for the site and angular distribution of electrons after multiple scattering in amorphous layers. (GE)

2216 MONTE-CARLO CALCULATIONS OF ELECTRON DIFFUSION IN Al AND Au FOR 10 TO 100 keV. Krefting, E. R. Muenster, Ger.; Univ. Muenster (1973). 81p. (In German). INIS.

Thesis.

Monte-Carlo calculations on the electron diffusion in Al and Au for directed, monoenergetic beams of 10-100 keV are described. The electron diffusion is reduced here to the calculation of single electron trajectories. For this calculation, the simple and multiple diffusion models are combined, and part of the energy loss is considered due to single collisions. The results of the calculation are compared with experimental values, and the relative error of the calculated results is estimated. (GE)

2217 RADIUM ISODOSE MAP FOR X-RAY STEREOSCOPIC RADIUM DOSIMETRY. Meyer, W. Duesseldorf; Univ. Duesseldorf (1973). 29p. (In German). INIS.

Thesis.

Isodose curves of 66 radium-activated applicators have been recorded. All radium filters used for carcinoma therapy at the Universitaetsfrauenklinik, Duesseldorf, were measured. Measuring equipment and measuring methods to record the isodose curves are given and described. The principle of the X-ray stereophotogrammetry method is explained. (auth)

Radiation Protection Standards

Refer also to abstracts 992 and 2430.

2218 (AED-CONF-75-103-001) PROBLEMS OF RADIATION PROTECTION CONTROL IN USING MEDICAL X-RAY EQUIPMENT FROM THE PRODUCER'S POINT OF VIEW. Ullrich, H. (Siemens A. G., Erlangen (F. R. Germany). Unternehmensbereich Medizinische Technik). 1975. 15p. (In German). INIS.

From symposium on practical experience with radiation protection control as specified in Paragraph 4.1 of the X-Ray Ordinance; Brunswick, F. R. Ger. (15 Apr 1975).

Some problems of performance testing of medical X-ray equipment as specified in paragraph 4.1 of the X-ray ordinance are discussed. Most of these problems have already been solved in individual cases, but the solutions are not generally known. Usually they are borderline cases recorded by different control authorities in the different federal lands. These cases were collected and evaluated for uniform administration in the GFR. (auth)

2219 RADIATION PROTECTION RULES, 1971. Bharat Ka Rajpatra.; No. 44, 4465-4473(30 Oct 1971).

General statutory rules for radiation protection framed by the Department of Atomic Energy, Bombay, have been issued by the Government of India, New Delhi. Various technical terms used in the text of rules are defined in legal context. These rules cover the various aspects of radiation protection such as (1) licensing (2) personnel employed in radiation work (3) restrictions to be observed in the use of radioactive materials (4) responsibilities, duties and functions of the radiological safety officer to be appointed for radiation surveillance (6) radiation symbol (7) employer's responsibilities (8) medical examination of radiation workers (9) powers of inspectors appointed to inspect radiation installations and inspection procedures (10) sealed and unsealed radiation sources (11) precautions in case of leakage and spillage of radioactive materials (12) mining, processing etc. of radioactive minerals. (INIS)

2220 RADIOLOGICAL PROTECTION IN RADIOLOGY. Calegaro, J. U. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). Bol. Inf. Soc. Bras. Radiol.; No. 33, 1-11 (Apr 1973). (In Portuguese).

From tenth meeting of radiology in Guanabara; Rio de Janeiro, Brazil (3 Sep 1972).

An introduction is given to the dangers of ionizing radiation. The three basic measures used for radiological protection are discussed, i.e., distance, exposure time, and barrier. Recommendations are presented concerning: equipment and accessories, installation of equipment and shielding, manner of using equipment, operator protection, and patient protection. (INIS)

2221 THERAPEUTIC INTEGRAL DOSE RATION IN THE MEGAVOLT THERAPY WITH ELECTRONS AND PHOTONS UP TO 45 MeV. Koester, W. Heidelberg; Univ. Heidelberg (1973). 65p. (In German). INIS.

Thesis.

The significance of whether to use ultra hard X-rays and fast electrons with energies above 20 MeV in radiotherapy and under what conditions compared to low-energy photon radiation have been investigated in this work. It has been shown that electrons as well as X-rays with energies up to 50 MeV can be applied advantageously compared with low-energy photon radiation such as ^{60}Co-γ-radiation. There is no point in using radiation with even higher energies from the therapeutical point of view. On the other hand, electron radiation of 40-50 MeV is necessary to exhaust the advantages compared with photon radiation of random energy. For focal depths up to about the middle of the body, electron rays give the smallest integral dose ratio, whereas for greater depths, ultra hard X-rays with energies up to 45 MeV produce the smallest therapeutical integral dose ratio. With ultra hard X-rays, however, by increasing the production voltage from 20 to 45 MeV, the therapeutical integral dose ratio can only be insignificantly diminished with larger body thicknesses. Contrary to this, the therapeutical integral dose ratio is clearly reduced by using electron radiation in the energy region of 20 to 45 MeV compared with photon radiation at any energy with focal depths to the body center. (auth)

Radiation Source Calibration and Standardization

Refer also to abstract 748.

Shielding Calculations and Experiments

2222 (JINR-P16-8871) ENGINEERING OF CALCULATION OF HIGH ENERGY PROTON AND ELECTRON SYNCHROTRON SHIELDING. Zaitsev, L. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1975. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Extremely simple and universal way has been suggested for calculation of the shielding of any configuration (except the traps) over the given losses of accelerated particles in the energy range from 1 up to 2000 GeV. The way is comfortable when operatively solving the problems of shielding and predicting the radiation situation. The error of the shielding thickness calculations is less than 10%. The investigation has been performed at the Laboratory of High Energies, JINR. (auth)

PHYSICS (THEORETICAL)

General

Refer also to abstract 1835.

2223 (ITP-75-44P) CAUCHY PROBLEM FOR THE BOGOLIUBOV KINETIC EQUATIONS: A QUANTUM CASE. Rasulova, M. Yu. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 11p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The paper investigates the Bogolyubov kinetic equations for an infinite quantum system of identical particles with density $1/\sigma$ which interact by means of the pair potential. The Cauchy problem for the equations in the space of sequences of nuclear operators is solved using the method of semigroups. (auth)

2224 (JINR-E2-8995) CLASSIFICATION OF DOMAINS OF OPERATOR ALGEBRAS. Lassner, G.; Timmermann, W. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The structure of domains of Op*-algebras G(D) is investigated; especially, there is considered the case where the domain D is a Frechet space with respect to a natural topology one obtains a complete classification and description of domains D. (auth)

2225 SOME NEW APPROACHES TO THE STUDY ON THE GENERALIZED WKB-APPROXIMATION. 3. Zhirnov, N. I.; Sokolov, A. A. (Moskovskij Gosudarstvennyj Pedagogicheskij Inst. (USSR)). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 10, 39-45 (Oct 1974). (In Russian).

For English translation see the journal Sov. Phys. J.

Within the framework of a new formalism of the generalized WKB-method, which was developed earlier, a look is taken at the problem of the passage of particles through a one-dimensional, potential barrier of arbitrary form. In addition a series of properties are assigned to the matrix $\hat{F}(S,S_1)$, which are necessary for the solution of concrete, quantum mechanical problems. (tr-SJR)

2226 SEPARATION OF VARIABLES IN A KLEIN-GORDON EQUATION. 3. Bagrov, V. G.; Meshkov, A. G.; Shapovalov, V. N.; Shapovalov, A. V. (Tomskij Gosudarstvennyj Univ. (USSR); Tomskij Meditsinskij Inst. (USSR). Tsentral'naya Nauchno-Issledovatel'skaya Lab.). Izv. Vyssh. Ucheb. Zaved., Fiz.; 6: No. 145, 74-78(1974). (In Russian).

For English translation see the journal Sov. Phys. J.

All types of external electromagnetic fields are found that contain arbitrary functions allowing a complete separation of variables in the Klein-Gordon equation by a single, differential, symmetry operator of first order and by two operators of second order. A presentation is given of the curvilinear coordinates, in which the variables are separated, and equations in the separated variables are written out. (tr-SJR).

2227 QUANTUM EFFECTS ON A MACROSCOPIC SCALE. Pradhan, T. (Institute of Physics, Bhubaneswar (India)). Sci. Cult.; 40: No. 7, 304-308(Jul 1974).

17 refs.

One of the important consequences of Bose statistics is the possibility of having a system that exhibits quantum mechanical effects on a macroscopic scale. This is made possible by the occupation of a single quantum state by a large number of Bose particles. Such a state is called a "condensate." (auth)

2228 THEORY OF 3nj COEFFICIENTS. Kuznetsov, G. I.; Smorodinskii, Ya. A. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 21: No. 5, 1135-1143(May 1975). (In Russian)

The graphical method of trees is applied to the theory of 3nj coefficients. Based on the method, the structure of the 3nj coefficients, their representation and some functional relations between the 6j symbols are studied. (auth)

Quantum Field Theories

Refer also to abstracts 1996, 2246, 2248, and 2254.

2229 (DESY-75/28) INTEGRABLE HAMILTONIAN SYSTEMS AND INTERACTIONS THROUGH QUADRATIC CONSTRAINTS. Pohlmeyer, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Aug 1975. 29p. Dep. NTIS (US Sales Only) $4.50.

O_n-invariant classical relativistic field theories in one time and one space dimension with interactions that are entirely due to quadratic constraints are shown to be closely related to integrable Hamiltonian systems. (auth)

2230 (KFKI-75-49) LIGHT FRONT QUANTIZATION BY DIRAC'S METHOD. Huszar, M. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Jul 1975. 26p. Dep. NTIS (US Sales Only) $4.25.

Commutation relations between fields and their conjugate momenta cannot be imposed on the light front $x^0 + x^3 = \text{const.}$ without any further ado because canonical momenta are functions of the fields themselves rather than of the velocities leading to constraints between fields and momenta. To perform light front quantization Dirac's method for the quantization of constrained systems is applied. For both the real and complex scalar fields, constraints are of the second class. Quantization is carried out through the Dirac bracket evaluated by means of constraints. If in light-front-quantized electrodynamics the gauge $A^+ = 0$ is imposed, constraints become second-class; subsidiary conditions do not arise, but constraints modify the result of naive quantization in a definite way. (auth)

2231 EQUIVALENT-PARTICLE APPROXIMATIONS IN ELECTRON AND PHOTON PROCESSES OF HIGHER-ORDER QED. Chen, M. (Stanford Linear Accelerator Center, Stanford, California 94305); Zerwas, P. Phys. Rev. D 12: No. 1, 187-197 (1 July 1975).

The method of equivalent-photon and -lepton approximations is applied to speedy estimates of higher-order QED cross sections in high-energy electron-positron annihilation and inelastic photon- and electron-nucleon scattering. The equivalent-particle spectra are derived with infinite-momentum-frame techniques. The limitations of the approximation scheme are discussed thoroughly. (auth)

2232 THE COMPOSITE FIELD THEORY AND STRATON MODEL. I. Zuo-xiu, H.; Tao, H. (Institute of Atomic Energy, Academia Sinica). Chin. J. Phys. 23: No. 4, 162-177 (July 1974).

The composite field theory investigated in ref. 1 is extended to the case where the elementary field is a spinor field. The various formulas used for the meson system in the straton model are given. (auth)

2233 PRINCIPLE OF COEXISTENCE IS GROUNDLESS. Chang, C. L. (Univ. of Science and Technology, Peking). Wu-li; 4: No. 2, 110; 126(18 Apr 1975). (In Chinese).

A dispute of the article entitled "A Theory of Morphisms between the Tardyons and Tachyons" by Chiang Ch'un-hsuan [5592 2504 2537] is made by pointing out that the so-called coexistence theory does not coincide with experimental results, that the parameters adopted are only the time, coordinates, and velocity of the same tachyons in two different inertia systems, and that the tardyon particles discussed are obviously the known results of the restricted theory of relativity. (JPRS)

2234 WHAT IS THE ESSENCE OF "A THEORY OF MORPHISMS BETWEEN THE TARDYONS AND TACHYONS". Liu, I. C. (Inst. of Mathematics, Peking). Wu-li; 4: No. 2, 125-126 (18 Apr 1975). (In Chinese).

The article entitled "A Theory of Morphisms between the Tardyons and Tachyons" by Chiang Ch'un-hsuan [5592 2504 2537] is disputed by pointing out that the correctness of the article depends at the minimum on the correctness of the "dual coexistence" assumption $\bar{v}v = c^2$, which has no practical basis, and that the author chose only transformations besides other morphisms was merely to obtain $\bar{v}v = c^2$, and the so-called tachyon Lorentz transformation. It is concluded that if there is no "dual coexistence" assumption, the content has nothing new, and the morphism is still tardyon motion. (JPRS)

2235 SELECTED TOPICS IN FIELD THEORY. Shaw, J. C. Stony Brook, NY; State Univ. of New York (1974). 104p. University Microfilms Order No. 75-4573.

Thesis (Ph. D.).

The first order formulation of massive quantum scalar electrodynamics is investigated. The method of functional integration is used to derive the new Feynman rules. One then studies the structures of full propagators of scalar field and the Ward identities. Finally a new proof is given that the term p/sup mu/p/sup nu/mu in the vector meson propagator actually does not contribute in the general Green's function and hence the theory is renormalizable. An explicit demonstration is given that the gauge field theory is identical to the theory of "connection on a vector bundles". In this way one introduces the conception of parallel displacement and generalizes the usual field theory on the flat space to the space with connection. Following Dirac approach, one also gives quantization rules for all field operators and then one shows that these commutation rules lead to the Poincare algebra of four momenta and angular momenta. (Diss. Abstr. Int., B)

2236 QUANTUM ELECTRODYNAMICS INCLUDING THE ELECTRON'S QUANTIZED GRAVITATIONAL FIELD IN AN ARBITRARY SPACE-TIME AND A FINITE CALCULATION OF

THE ELECTRON SELF-ENERGY. Bridges, D. L. Eugene, OR; Univ. of Oregon (1974). 160p. University Microfilms Order No. 75-12,524.

Thesis (Ph. D.).

The problem of the infinite renormalization constants of quantum electrodynamics is considered. By applying the methods of Schwinger's equations and nonpolynomial Lagrangians, expressions for the electron and photon propagators, modified by the particles' quantized gravitational fields in an arbitrary curved space-time, are obtained. It is then shown by specializing the curved space-time to the Reissner metric that the lowest order corrections to the electron self-energy and charge renormalization are finite with values delta m/m equals .18 and delta e/e equals -.04. (Diss. Abstr. Int., B)

2237 MODIFIED FIELD THEORY FOR QUARK BINDING. Kiskis, J. E. Jr. Stanford, CA; Stanford Univ. (1975). 74p. University Microfilms Order No. 75-13,541.

Thesis (Ph. D.).

The structure of modified field theories was investigated. Higher derivatives are introduced into the Lagrangian in such a way that the bare propagator becomes q^{-4} rather than q^{-2}. A modification of this type to the gluon propagator in a quark-gluon model gives the possibility of permanent quark binding. It is found that such a model has difficulties with unitarity and with infrared divergences when treated in naive perturbation theory. If the problems associated with going beyond perturbation theory can be overcome, these difficulties may be eliminated. (Diss. Abstr. Int., B)

2238 SOME PROBLEMS AND MODELS RELATING TO THE ELASTIC SCATTERING OF HADRONS AT VERY HIGH ENERGIES. Davidson, M. P. Urbana, IL; Univ. Illinois (1974). 133p. University Microfilms Order No. 75-11,790.

Thesis (Ph. D.).

A nonlinear form of the Bethe-Salpeter equation is studied and used to put restrictions on the asymptotic behavior of two-particle exchange in the Regge limit. The crucial input leading to these bounds is the satisfaction of the Froissart bound off the mass shell for full amplitudes. The calculations are performed for two-pion exchange in pi-pi-scattering and for two-photon exchange in massive quantum-electrodynamics. Implications for CERN and NAL experiments are discussed. A means of imposing t channel unitarity constraints on eikonal models is introduced. A bootstrap equation is thus found whose solution is a fixed pole at J equals 1 leading to nonshrinking differential cross sections at infinite energies, as suggested by CERN data for t less than -.2 GeV^2. The large direct channel energy limit of the Sommerfeld-Watson transform is derived. This enables simple analytic continuation of amplitudes in impact parameter representation outside the Lehman ellipse. It also facilitates the derivation of large q^2 limits of eikonal amplitudes. The large q^2 limit of a number of such amplitudes is presented. (Diss. Abstr. Int., B)

2239 INTRODUCTION TO AXIOMATIC QUANTUM FIELD THEORY. Bogolubov, N. N.; Logunov, A. A.; Todorov, I. T. Mathematical Physics Monograph Series. Reading, MA; W. A. Benjamin, Inc. (1975). 728p.

Translation of Osnovy aksiomaticheskogo podkhoda v kvantovoi teorii polia by Stephen A. Fulling and Ludmila G. Popova.

The treatment of axiomatic quantum field theory includes the elements of functional analysis and the theory of distributions, the general principles of relativistic quantum theory, local quantum fields and Wightman functions, asymptotic conditions and scattering theory, axiomatic S matrix theory, consequences of the relativistic invariance of quantum theory: TCP, spin, and statistics, the Haag theorem, the quantum theory of local observables, and progress in constructive quantum field theory. A bibliography is included. (JFP)

2240 LOCAL OPERATOR PRODUCTS AND FIELD EQUATIONS IN $P(\varphi)_2$ THEORIES. Schrader, R. (Freie Univ., Berlin). Fortschr. Phys.; 22: No. 11, 611-631(1974).

In $P(\varphi)_2$ theories with small coupling constants, local fields exist which are obtained from normal ordering of Euclidean fields. Normal ordering with respect to the free measure and the physical measure leads to the same family of fields. The coefficients of the two resulting equations are related by a fixed point problem. Conditions are exhibited under which there is a unique solution. (auth)

2241 NEW AXIOMATIC RESTRICTIONS ON THE DIFFERENTIAL AND TOTAL CROSS SECTIONS. Lomsadze, Yu. M.; Kelemen, V. I. (Inst. of Theoretical Physics, Uzhgorod, USSR). Yadern. Fiz.; 21: No. 5, 1117-1125(May 1975). (In Russian).

New integral and local relations between the differential and total cross sections are obtained. The relations are based only on the general properties of scattering amplitude which are rigorously proved within the axiomatic quantum field theory. These relations may serve both the aim of experimental verifications of the quantum field theory principles and, consistent with these principles, theoretical predictions of the behavior of these cross sections in the energy region that is not experimentally available now. (auth)

2242 RECONSTRUCTION OF QUANTUM FIELDS FROM EUCLIDEAN GREEN'S FUNCTIONS AT ARBITRARY TEMPERATURES. Frohlich, J. (Princeton Univ., NJ). Helv. Phys. Acta; 48: 355-363(1975).

Results on the reconstruction of equilibrium states on the Borchers field algebra of quantum fields at arbitrary temperature from Euclidean Green's functions are announced and described. These results are applied to a large class of models of a self-interacting, local, neutral, scalar fields in two space-time dimensions for which the Euclidean Green's functions in the infinite volume limit can be constructed at arbitrary temperatures. They can be (and were) applied to nonrelativistic field theories at positive temperature. (auth)

Gravitation and General Relativity

2243 (JINR-E2-8909) DYNAMICAL AFFINE SYMMETRY AND COVARIANT PERTURBATION THEORY FOR GRAVITY. Pervushin, V. N. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 20p. Dep. NTIS (US Sales Only) $4.00.

The covariant perturbation theory for gravity with the simplest reduction properties is formulated. The main points are as follows: fundamental fields are the normal coordinates of ten-dimensional space of the gravitational field, and the fields are separated into the classical (background) and quantum ones in the generating functional along geodesics of this space. (auth)

2244 TO THE PROBLEM OF SINGULARITIES IN SOLUTIONS OF THE EINSTEIN EQUATIONS FOR A STATIC SPHERICALLY SYMMETRIC FIELD. Pugachev, Ya. L.; Gun'ko, V. D. (Kubanskij Gosudarstvennyj Univ., Krasnodar (USSR)). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 10, 46-50(Oct 1974). (In Russian).

For English translation see the journal Sov. Phys. J.

A study is made of the character of particular features in solutions of the Einstein equations for a static, spherically-symmetric field as a function of the selection of supplementary conditions. It is shown that the main feature—the Schwarzschild sphere—may be created or established by means of a set of conditions without changing the physical assumptions and the gravitational equations themselves. Various solutions, which are equivalent from the observational point of view, are obtained, since the theoretical variations of astronomical effects are far beyond the limits of the experimental possibilities. (tr-SJR)

2245 ON THE MODEL OF INTERIOR GRAVITATIONAL COLLAPSE. Nekrasov, A. G. (Tomskij Politekhnicheskij Inst. (USSR)). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 8, 47-50 (Aug 1974). (In Russian).

For English translation see the journal Sov. Phys. J.

The concept of internal gravitational collapse is introduced. The metric associated with the initially collapsing sphere and with collapse of the spherical layer is found. (tr-SJR)

2246 MICROGEON WITH A KERR'S METRIC. Burinskij, A. Ya. Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 8, 21-24(Aug 1974). (In Russian).

For English translation see the journal Sov. Phys. J.

A look is taken at the structure of the electromagnetic and gravitational fields near a singular ring of Kerr metric. For a metric with parameters of an electron an approximate joint solution is given for the set of Maxwell–Einstein equations that describes a microgeon which models an electron. A new interpretation is given of Kerr duality. (tr-SJR)

2247 ELECTROMAGNETIC FIELDS AND TORQUE FOR A ROTATING GYROSCOPE WITH A SUPERCONDUCTING SHIELD. Ebner, C. (Department of Physics, The Ohio State University, Columbus, Ohio 43210); Sung, C.C. J. Appl. Phys. 46: No. 9, 4053-4060 (Sept 1975).

In a proposed experiment, a measurement is to be made of the angular precession of a rotating superconducting gyroscope for the purpose of testing different general relativity theories. For various reasons having to do with the design of the experiment, the superconducting shield surrounding the gyroscope is not spherically symmetric and so produces a torque. There are two distinct features of the shield which lead to a torque on the gyroscope. First, its shape is a sphere intersected by a plane; if the angular momentum of the gyroscope is not parallel to the rotational symmetry axis of the shield, there is a torque which we calculate. Second, there are small holes in the spherical portion of the shield; the earth's field can penetrate through these holes and give an additional torque. This is also calculated here. In the actual experiment these torques must be

accurately known or made very small in order to obtain meaningful results. Our calculation is sufficiently general for application over a wide range of experimental design parameters. (auth)

2248 QUANTUM ELECTRODYNAMICAL EFFECTS IN KERR-NEWMANN GEOMETRIES. Damour, T. (Joseph Henry Physical Laboratories, Princeton University, Princeton, New Jersey 08540); Ruffini, R. Phys. Rev. Lett. 35: No. 7, 463-466 (18 Aug 1975).

Following the classical approach of Sauter, of Heisenberg and Euler and of Schwinger the process of vacuum polarization in the field of a "bare" Kerr-Newman geometry is studied. The value of the critical strength of the electromagnetic fields is given together with an analysis of the feedback of the discharge on the geometry. The relevance of this analysis for current astrophysical observations is mentioned. (auth)

2249 HIGHER-DIMENSIONAL UNIFICATIONS OF GRAVITATION AND GAUGE THEORIES. Cho, Y.M. (The Enrico Fermi Institute and the Department of Physics, The University of Chicago, Chicago, Illinois 60637). J. Math. Phys. (N.Y.) 16: No. 10, 2029-2035 (Oct 1975).

We give a comprehensive geometric treatment of Kaluza–Klein type unifications of non-Abelian gauge theories with gravitation. The appearance of a cosmological term is noted. (auth)

2250 A POSSIBLE UNIFICATION OF GRAVITATION AND ELECTRODYNAMICS BOTH FOR SPINLESS AND SPINNING MEDIA. Mahanta, M.N. (Department of Mathematics, Indian Institute of Technology, New Delhi-110029, India). J. Math. Phys. (N.Y.) 16: No. 10, 2106-2108 (Oct 1975).

It was shown by the author recently that the Einstein–Mayer formalism of 1931–32 can be successfully applied to derive the field equations for a spinning medium. The present article discusses the possibility of obtaining a unified representation of gravitation as well as electromagnetism both for spinless and spinning media with the help of the same formalism. Field equations and equations of motion for a point particle are derived for both cases. (auth)

2251 SOLUTIONS OF A SCALAR–TENSOR THEORY FROM EINSTEIN'S THEORY. Singh, T. (Department of Mathematics, University of Gorakhpur, Gorakhpur 273001, India). J. Math. Phys. (N.Y.) 16: No. 10, 2109-2111 (Oct 1975).

The vacuum field equations of a scalar–tensor theory proposed by Sen and Dunn are investigated. The metric coefficients are assumed to be functions of three variables only. It is then shown that if one assumes a functional relationship between some one of the metric coefficients and the scalar function, one can find a solution of the vacuum field equations of Sen and Dunn's scalar–tensor theory in terms of a solution of the vacuum field equations of Einstein's theory. This result is applied to some well-known solutions, viz., Schwarzschild solution, the static plane symmetric solution of Taub, the conformastat solution of Das, and the static axially symmetric solutions of Levi-Civita and Curzon; and the corresponding solutions of the scalar–tensor theory are obtained. (auth)

2252 AN EXACT SPHERICALLY SYMMETRIC LOCAL SOLUTION IN A CLASS OF "STRONG" AND "WEAK" TWO-TENSOR GRAVITY THEORIES. Hammel, W.C. (Department of Physics, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin 53201). J. Math. Phys. (N.Y.) 16: No. 10, 2114-2122 (Oct 1975).

After defining simultaneous spherical symmetry for two metrics, the technique of equation splitting is used to produce exact spherically symmetric solutions within the class of two-metric gravity theories introduced in an earlier paper. The nontrivial solutions are found to select the exceptional case, distinguished in previous work. The solutions in this case, however, possess a "gauge freedom" which apparently leaves the physics ambiguously defined. Nevertheless, we use the gauge freedom to simplify and proceed to local solutions, where ^1g. is an empty closed space of positive constant curvature and ^0g. is a Schwarzschild solution with a mass. The empty closed space is found to be contained within the Schwarzschild radius. (auth)

2253 THE KINEMATIC EFFECT IN THE CLASSICAL DOMAINS AND THE RED SHIFT PHENOMENA OF EXTRAGALACTIC OBJECTS. Qi–keng, L.; Zhen–long, Z.; Han–ying, G. (Institute of Mathematics, Academia Sinica). Chin. J. Phys. 23: No. 4, 139-147 (July 1974).

Starting from the principle of relativity and the local constancy of the velocity of light, in this paper we establish a space—time model with the classical domain $D_\lambda(1,4)$. We discuss the kinematic effect in it and calculate the frequency shift of the spectral line. Moreover, under the assumption of uniform distribution we compare our result with the observational data of the quasar N—Z relation. Our result shows that the large red shift in the extragalactic objects perhaps is not caused mainly by the Doppler effect, but to a large extent is a distance effect in the $\lambda<0$ region of the classical domain. Thus the classical domain $D_{\lambda<0}(1, 4)$ [its group of motion being SO(3,2)] is possibly a better model for large–scale space–time. (auth)

2254 EXTERNAL GRAVITATIONAL INTERACTIONS IN QUANTUM FIELD THEORY. Freedman, D.Z. (Institute for Theoretical Physics, State University of New York, Stony Brook, New York 11794); Pi, S. Ann. Phys. (N.Y.) 91: No. 2, 442-449 (June 1975).

We consider the renormalization of Green's functions of $\lambda\phi^4$ quantum field theory in an external gravitational field specified by the metric tensor $g^{\mu\nu}(y)$. Green's functions $\Gamma^{(n,j)}$ describing the interaction of j scalar particles to arbitrary order n in the gravitational field are shown to be made finite by the standard renormalizations of the flat-space theory and a renormalization of the coefficient of the improvement term in the action functional. These results in ϕ^4 theory can be extended to all renormalizable field theories. (auth)

2255 GRAVITATIONAL COLLAPSE IN THE PROJECTIVE THEORY OF RELATIVITY. Kallio, H. (Oulu Univ., Finland). Ann. Acad. Sci. Fenn., Ser. A VI.; No. 414, 1-9(1974).

The equations describing in Jordan's projective theory of relativity the geometry outside a collapsing spherically symmetric mass distribution are studied. They are found to have also a time-independent solution, which coincides with Heckmann's solution. As an application the free-fall collapse of a star in Heckmann's geometry is examined. It is shown to stop after a finite elapse of time and to turn into an expansion. (auth)

2256 POLYTROPIC STELLAR MODELS IN THE PROJECTIVE THEORY OF RELATIVITY. Kallio, H. (Oulu Univ., Finland). Ann. Acad. Sci. Fenn., Ser. A VI.; No. 411, 1-29(1974).

Polytropic stellar models in the projective theory of relativity are studied. There are solutions very accurately equivalent to general-relativistic polytropes examined by Tooper, but also quite different solutions, which give very large redshifts. (auth)

2257 LENSE–THIRRING EFFECT AND LOCALIZABILITY OF GRAVITATIONAL ENERGY-MOMENTUM. Chevalier, J. (Univ. of Geneva). Helv. Phys. Acta; 48: 383-389(1975).

The Lense-Thirring solution is analyzed in connection with the problem of the gravitational energy-momentum localization in general relativity. Using Møller's conditions for the tetrads, it is shown that for great distances from the source the gravitational energy has a well determined velocity proportional to r^{-1}. The same result is obtained for the analogous problem of electrodynamics, according to the well known Maxwellian character of general relativity in the case of the weak field. The notion of angular momentum then allows, in principle, the exclusion of some possible gravitational energy-momentum distributions. Thus, in opposition to some opinions, it would not be impossible to localize the gravitational energy-momentum. (auth)

REACTOR TECHNOLOGY AND REGULATION

2258 (INIS-mf-1702, pp 89-99) SYSTEM AND DEVICES FOR OPERATIONAL CONTROL OF NUCLEAR POWER PLANT EQUIPMENT METAL AND WELDING JOINTS. Zlepko, V. F.; Shabnov, N. N.; Gladkov, Y. K.; Moronov, V. N. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

This study presents the main principles of organizing and assuring inspection of the condition of the metal in radioactive loops of a nuclear power plant, and also a description of a number of devices is given by means of which it is possible to carry out periodic checks in highly radioactive sections of a water-water power reactor. (tr-SJR)

2259 (INIS-mf-1702, pp 123-136) PROBLEMS IN TRAINING OPERATORS FOR NUCLEAR POWER PLANTS. Malashinin, I. I.; Sidorova, I. I. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

This paper gives the characteristics of nuclear power operating personnel and the requirements for qualifying personnel in this field. Program structure and methods of teaching operating personnel are considered. Significant effort is devoted to training devices as the most efficient means of preparing nuclear power operating personnel. Principles of constructing training models are formulated, and criteria are presented for the equivalence of the model and the process. Criteria are also given for the quality of the model as a training device. The possibilities and effectiveness of the training devices are considered. (tr-SJR)

2260 (INIS-mf-1702, pp 137-148) DEVELOPMENT OF TECHNICAL MEANS FOR DECONTAMINATION OF RADIOACTIVE EQUIPMENT OF NUCLEAR POWER PLANTS. Vlasov, I. N.; Voronezhev, L. N.; Orekhov, V. M.; Sedov, V. M.; Simanovskii, Yu. M. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

The parts of a nuclear plant that may be dangerous from a radiation point of view are described. A look is taken at the optimal characteristics of technical accessories intended for decontaminating a nuclear power plant having reactors of the RBMK-1000 type, including replaceable equipment, cells and also the internal surfaces of the primary reactor core. Technical means of introducing protective deposits are discussed. (tr-SJR)

2261 (INIS-mf-1702, pp 206-223) SPECIFIC FEATURES OF PARALLEL OPERATION OF THERMAL AND FAST REACTORS. Lytkin, V. B.; Kagramanyan, V. S. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

By analyzing a system of fast and thermal reactors of the type LVR this study obtains estimates of the efficient use of fissionable materials. By using these estimates it is possible for the authors to determine as a first approximation the fuel requirements and characteristics of thermal and fast reactors which are introduced at various periods. (tr-SJR)

2262 (INIS-mf-1702, pp 251-261) PROSPECTS OF DEVELOPMENT OF NUCLEAR POWER PLANTS WITH THERMAL REACTORS. Orlov, V. V.; Sharapov, V. N.; Galanin, A. N. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

Fast neutron reactors because of expanded breeding at nuclear power growth rates up to 10% per year can generate excess plutonium or uranium-233 in thorium mantles. This excess fuel can be used for thermal reactors having good economical indices. Thus this nuclear power system consists of fast and thermal reactors. The fraction of power from thermal reactors depends on the characteristics of reactors of both types. High-temperature, gas-cooled reactors with a helium coolant and graphite moderator present the best possibilities among the thermal reactors in this regard. According to the estimate of the authors the fraction of power from these reactors with the use of a uranium-thorium cycle can attain 50 to 80%. (tr-SJR)

2263 SA-US ATOM DEAL. Financ. Mail.; 54: No. 9, 861 (29 Nov 1974).

The USAEC signed a contract with ESCOM earlier this year for enrichment services for up to 2000 MW. These enrichment services are needed for the N-power station KOEBERG A, being built by ESCOM in the Cape. The cost for such enrichment runs to about $10m for a 1000 MW reactor. (INIS)

2264 SOUTH AFRICA IN A NUCLEAR WORLD. Roux, A. J. A. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). S. Afr. Int.; 4: No. 3, 149-167(Jan 1974).

The rate of growth in the development and application of nuclear energy is described. It is expected that by the year 2000, not less than 50% of the total electricity generating capacity will be provided by nuclear energy. In order to maintain the rate of growth, the availability of fuel and the production of enriched uranium are necessary. The situation regarding uranium in the free world and in South Africa is discussed. Mention is made of an intensification in South Africa's program of exploration. There are two technological developments which, in time, will serve to keep the increasing demand for uranium in check. These are the recycling of plutonium and the development of fast breeder reactors. The world situation with regard to the enrichment of uranium is discussed. South Africa has developed a new process for uranium enrichment with a view to clearing the way to finally being able to market her huge uranium sources in the most refined forms. Work on the pilot plant is proceeding according to schedule. 90% of the pilot plant will be of South African manufacture. This has resulted in giving a new stimulus to South African industry for its transition from conventional to sophisticated manufacture. As far as the South African process for enrichment is concerned, the production cost in a plant erected in South Africa could be 20% lower than those for a gaseous diffusion plant of similar size erected in the USA. It is mentioned that the energy consumption of the South African process has, over the past eight years, been almost halved every two years. (INIS)

2265 NUCLEAR TECHNOLOGY IN THE SWISS RESEARCH POLICY. Hochstrasser, U. Schweiz. Bauztg.; 92: No. 40, 921-923(3 Oct 1974). (In German).

The development of the Swiss nuclear power station program in a short space of time has required a close partnership between industry, academic research, and state authorities. The part played by the Swiss Institute for Nuclear Research and the EIR, Federal Institute for Reactor Research, is briefly described. In particular the present and future roles of the EIR are discussed, and the manner in which its activities can complement fundamental long-term academic research and short-term industrial research and the problems it can best help to solve are considered. (INIS)

2266 FUEL FOR THE FUTURE. II. Nuclear Power from Thermal Reactors. Diamant, R. M. E. Heating and Ventilating Engineer; 49: No. 574, 22-26(May 1975).

A brief explanation of the fundamentals of nuclear power and the nuclear reactor is followed by summaries of the different types of thermal reactors. The characteristic features of each type of reactor are briefly summarized, and attention is drawn to any advantages, disadvantages, or special problems associated with a particular type of reactor. (UK)

2267 OPERATING EXPERIENCE: REPORTS FROM WORLD NUCLEAR POWER STATION SITES. Nucl. Eng. Int.; 20: No. 230, 467-479(May 1975).

Operating experiences for 46 nuclear stations are summarized under the following countries: Canada, France, Germany, India, Italy, Japan, Sweden, Switzerland, U.K. and USA. (auth)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 2318, 2431, 2433, 2434, 2438, 2439, 2518, 2521, 2523, 2524, 2530, 2531, 2535, and 2537.

2268 (IFK-11/73) ANALYSIS OF REACTOR NOISE IN BOILING WATER REACTORS. Seifritz, W. (Technische Univ. Hannover (F. R. Germany). Inst. fuer Kerntechnik; Technische

Univ. Hanover (F. R. German). Fakultaet fuer Maschinenwesen). 1972. 154p. (In German). INIS.

Thesis.

The paper contains some basic thoughts on the problem of neutron flux oscillations in power reactors. The advantages of self-powered detectors and their function are explained. In addition, noise measurements of the boiling water reactors at Lingen and Halden are described, and the possibilities of an employment of vanadium detectors for the analysis of reactor noise are discussed. (GE)

2269 (INIS-mf-1703, pp 201-217) STRUCTURAL MATERIAL CORROSION UNDER OPERATING CONDITIONS OF THE PRIMARY CIRCUIT OF NUCLEAR POWER PLANTS WITH THE BWR TYPE REACTORS. Gerasimov, V. V.; Gromova, A. I.; Belous, V. N.; Shut'ko, I. G.; Volkhonskii, E. V.; Zelenov, V. I.; Klyushin, V. V.; Dvinyaninov, V. N. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

Reasons are given for using steels of the austenitic and perlitic classes, and zirconium alloys as construction materials in the circulating loop of reactors of the boiling-water type. The corrosion mechanism of construction materials is described. The effect of irradiation on the behavior of construction materials is shown. Safe concentrations of oxygen and chloride ions are estimated for steels of the austenitic class. It is shown that it is possible to use steels of the perlitic class under the operating conditions of boiling-water reactors. (tr-SJR)

2270 (INIS-mf-1703, pp 218-232) STUDY ON STEAM SEPARATION IN A PRESSURE VESSEL BOILING REACTOR WITH COOLANT FREE CIRCULATION. Kozlov, Yu. V.; Sokolov, I. N.; Solov'ev, Yu. A.; Zabelin, A. I. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

During studies directed to increasing the power of VK-50 reactor, unique investigations were made on separating vapor within the reactor. Data were obtained on the type of increase in water level over the gravity cutoff, and the separation characteristics were investigated over a wide range of changes in reactor power and water level. From the results of the study it is possible to propose a new technique of designing steam separation in boiling-water reactors having natural circulation of the coolant. This knowledge makes it possible to determine more rationally the basic construction dimensions of reactors of this type. (tr-SJR)

2271 (NEDC-20989-1) MARK I CONTAINMENT EVALUATION SHORT TERM PROGRAM: FINAL REPORT. Volume I, Program Description and Summary of Conclusions. Humphrey, J. M.; Masters, W. Z.; Rally, F. C.; Sumida, R.; Wolff, H. (General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.). Sep 1975. vp. General Electric Co., San Jose, CA.

An evaluation is presented of twenty-three Mark I containments subjected to the dynamic effects from the most probable pool dynamic loads induced by the postulated design basis accident. The evaluation herein verifies the Mark I containments will retain their structural integrity and will remain functional when subjected to the above loads, even though some of these loads were not explicitly included in the original containment design bases. One plant presently under construction will require minor modifications in order to assure structural integrity. (auth)

2272 (NEDO-20340-2) PROCESS COMPUTER PERFORMANCE EVALUATION ACCURACY. Amendment 2. Licensing Topical Report. Carew, J. F. (General Electric Co., San Jose, Calif. (USA). BWR Projects Dept.). Sep 1975. 5p. General Electric Co., San Jose, California.

This second amendment to Licensing Topical Report NEDO-20340, "Process Computer Performance Evaluation Accuracy", is provided in response to requests for additional information as conveyed by an enclosure with a letter to Mr. Ivan F. Stuart from Mr. Walter R. Butler dated June 13, 1975. (auth)

2273 (VTT-YDI-3) TRANSHEX: A TWO-DIMENSIONAL MULTICROUP COLLISION PROBABILITY COMPUTER PROGRAM FOR HEXAGONAL GEOMETRY. Patrakka, E. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Jun 1973. 69p. Dep. NTIS (US Sales Only) $6.50.

TRANSHEX is a multigroup integral transport program that determines the thermal scalar flux distribution arising from a known epithermal flux in two-dimensional hexagonal geometry. The program solves the isotropic collision probability equations for a region-averaged scalar flux by an iterative method. Either a successive over-relaxion or an inner-outer iteration technique is applied. Flat flux collision probabilities between trigonal space regions with white boundary condition are utilized. The effect of epithermal flux is taken into consideration as a slowing down source that is calculated for a given spatial distribution and 1/E energy dependence of the epithermal flux. 8 references. (auth)

2274 (VTT-YDI-9) FASTRUNNING COMPUTER PROGRAM FOR THERMAL NEUTRON CELL CALCULATIONS. Karppinen, J.; Saastamoinen, J. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Nov 1973. 16p. Dep. NTIS (US Sales Only) $4.00.

The computer program FACEL calculates the thermal neutron flux distribution in a LWR fuel rod cell. FACEL also prepares few group diffusion parameters for fuel assembly diffusion calculation and isotopewise microscopic cross sections for burnup calculation. The spatial flux variation is solved by the partial neutron current method based on first-flight escape and transmission probabilities. The energy point method is applied for the energy variable. The program is intended as the thermal part of a fast running fuel rod cell module of a fuel assembly burnup calculation program. FACEL is written in FORTRAN V for UNIVAC 1108. 7 references. (auth)

2275 STEEL PROBLEM FOR WATER-COOLED REACTORS (SIEMENS-ERLANGEN COMPANY). pp 1-32 of Materials for High Pressure Vessels of Atomic Power Plants. Moscow; NIIINFORMTYaZhMASh (1973). (In Russian).

Review on power equipment.

Experimental work from the Austrian firm "Siemens-Ehrlanger" on development of steel for water-cooled nuclear reactors was examined. The action of neutron radiation on the steel components of the reactor is described in detail. One criterion for the pressurized-water reactor vessel uniformity of structure, which ensures uniformity of properties along all cross-sections. The chemical compositions (%) of steels currently used for these vessels are given. For all industrial processes, numerous careful tests, ultrasonic and x-ray monitoring for cracks, etc. are described. Review of the use of steels in industrial reactors shows a close relation between calculations and special properties of the material. (INIS)

2276 TRANSPORT OF RADIOACTIVE CORROSION PRODUCTS IN HIGH-TEMPERATURE WATER. I. Recirculating Loop Experiments. Lister, D. H. (Chalk River Nuclear Labs., Ontario). Nucl. Sci. Eng.; 58: No. 2, 239-251(Oct 1975).

A stainless-steel loop containing recirculating, pressurized water at 300°C and neutral pH has been used to investigate the processes by which surfaces in nuclear reactor coolant circuits can become contaminated by radioactive corrosion products. By measuring deposition rates of activity onto metals (usually stainless steel) under different conditions and by examining exposed surfaces, it was deduced that the corrosion of the test surface controls the activation. Hence, the traditional phenomenological method of describing activation by first-order deposition and release coefficients is an oversimplification. (auth)

2277 NUCLEAR REACTOR COOLING SYSTEMS. Middleton, J. E.; Currie, T. (to British Nuclear Design and Construction Ltd.). British Patent 1,394,752/B/. 21 May 1975. Filed date 22 Mar 1972. 10p.

Reference is made to cooling systems for water cooled reactors. Some disadvantages of conventional systems are stated, and a system to overcome some of the disadvantages is described. The system includes a number of header and sub-header pipes, a steam drum, water pumps, and pressure tubes. Full constructional and operational details are given. (UK)

2278 RELIABILITY AND PERFORMANCES OF US LIGHT-WATER COOLED REACTORS. Griemes, B. K. (Atomic Energy Commission Directorate of Licensing, Washington, DC). Annals of Nuclear Energy; 2: No. 1, 33-35(Jan 1975).

The results of two studies by the Office of Operations Evaluation of the USAEC, one on nuclear power plant availability for 1973 and the other on abnormal occurrences in 1973 which influenced the availability statistics, are summarized and discussed. New procedures and changes in quality assurance activities which are being introduced are described, and brief comparison is made of nuclear power plants with large fossil units. (UK)

2279 FOURIER EXPANSION AS AN AID IN THE SOLUTION OF THE DIFFUSION EQUATION FOR THREE-DIMENSIONAL POWER DISTRIBUTIONS IN WATER MODERATED REACTORS. Jonsson, A. Ann. Nucl. Sci. Eng.; 2: No. 1, 17-24(Jan 1975).

The problem of predicting axial power peaking factors in water moderated reactors is not adequately solved by so called course

mesh methods for the solution of the neutron diffusion equation. The Fourier expansion method, briefly described, gives an essentially continuous representation of axial power shapes and therefore a higher precision in the peaking factors. It does this with a precision equivalent to fine mesh 3D methods yet it is shown to require $1/5$ to $1/10$ of the numerical work needed for fine mesh. Applications to 3D core power calculations for different types of water reactor (the HWR, BWR and PWR) are illustrated by a range of measured and calculated axial power distributions. These applications have been collected from 10 years of experience with the method. The comparisons show that the Fourier expansion method is well suited to LWR applications. (auth)

2280 REPORTED EXPERIENCES OF US PLANT DESIGN FOR LIGHT WATER NUCLEAR POWER REACTORS IN RELATION TO CURRENT USNRC REGULATIONS. Richardson, J. A. (Electrowatt Engineering Services Ltd., London). J. Br. Nucl. Energy Soc.; 14: No. 3, 201-211(Jul 1975).

The operating performance of light water reactors in the USA is reviewed. Included is a discussion of reported incidents and abnormal "occurrences" among the 42 plants in operation and of the extent to which the occurrences have influenced utility owners, suppliers of the nuclear station supply systems, architect-engineers, and component manufacturers. Special attention is paid to the reporting procedures enforced by the Nuclear Regulatory Commission on plant operations. The general situation of the U.S. nuclear industry, with respect to the latest Regulatory Guides, environmental activities, and future plant designs, is also considered. (UK)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 2273–2280, 2318, 2378, 2421–2424, 2427, 2431, 2433, 2434, 2437, 2439, 2440, 2455, 2520, 2522, 2525–2529, 2535, and 2537.

2281 (CENPD-169) COLSS: ASSESSMENT OF THE ACCURACY OF PWR OPERATING LIMITS AS DETERMINED BY THE CORE OPERATING LIMIT SUPERVISORY SYSTEM. Reactor Design Instrumentation and Controls Engineering. Pasquenza, J. P.; Church, J. F.; Foster, R. G.; Humphries, J. R.; Kadak, A. C. (Combustion Engineering, Inc., Windsor, Conn. (USA)). vp. Combustion Engineering Inc., Windsor, CT.

The methods used in the Core Operating Limit Supervisory System to process sensor information and evaluate the margins to various core operating limits are described. A detailed examination of the uncertainties associated with the methods used to synthesize the three-dimensional peaking factor (Fq), the "static" DNB power operating limit, and ability of COLSS to accommodate the effects of azimuthal tilts and CEA misalignments, and the effect of in-operable in-core detectors on the accuracy of the Fq and DNB calculations are presented. The uncertainty assigned to the calculated Fq and "static" DNB power operating limit due to the methods used in COLSS are respectively 4.8 percent and 1.9 percent at a 95/95 confidence level. (auth)

2282 (CENPD-187(Suppl. 1)) CEPAN: METHOD OF ANALYZING CREEP COLLAPSE OF OVAL CLADDING. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Oct 1975. 15p. Combustion Engineering, Inc., Windsor, CT.

CENPD-187, a topical report describing calculational methods used by C-E to analyze the creep collapse behavior of oval cladding, was transmitted to the NRC on May 29, 1975. A request for additional information was issued by the NRC, referenced below, on July 21, 1975. This supplement provides C-E's response to the eight (8) questions contained in the referenced NRC request. (auth)

2283 (INIS-mf-1702, pp 73-80) LEAKTIGHTNESS CONTROL OF PRIMARY CIRCUIT EQUIPMENT OF NUCLEAR POWER PLANTS WITH WWER AND RBMK REACTORS WITH THE USE OF RADIOACTIVE NOBLE GASES. Gochalieva, K. B.; Shabanov, N. N.; Fedulov, V. F.; Trusov, A. I.; Dubkov, A. P.; Zakhar'in, L. S. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

This study considers problems in controlling the leaktightness of equipment in the primary loop of a nuclear power reactor. A technique is proposed for detecting a leak and its magnitude by measuring the activity of reference isotopes. (tr-SJR)

2284 (INIS-mf-1702, pp 100-109) EXPERIENCE IN THE EQUIPMENT METAL QUALITY AND STATE CONTROL AT THE NOVO-VORONEZH NUCLEAR POWER STATION. Kustov, I. I.; Golubev, L. I.; Kruglov, V. P.; Sergunov, V. T.; Degtyannikov, Yu. F. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

In the construction of energy production units and annual, planned-preventive maintenance at the Novo-Voronezh nuclear power plant the inspection of the condition of metal in the basic equipment is carried out. Problems in organizing this inspection and the possibilities of using well-known, nondestructive methods to inspect metal in the equipment at the nuclear power plant having reactors of the WWER type are discussed. It is shown that the equipment for a nuclear power plant from the manufacturer comes in with numerous defects whose detection and removal are the main problems. The detection of defects and an analysis for the reason for the occurrence of the defects during testing are the main problems during planned preventive maintenance. (tr-SJR)

2285 (INIS-mf-1702, pp 110-122) EXPERIENCE IN THE PRIMARY CIRCUIT FAILURE DETECTION AT THE NOVO-VORONEZH NUCLEAR POWER STATION. Sedov, V. K.; Golubev, L. I.; Kruglov, V. P.; Adamenkov, K. A.; Samarin, A. A.; Nozdrin, G. N.; Popov, M. A. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

A presentation is given of the basic principles of vibroacoustical diagnostics of defect detection and control of equipment in the main loop of a thermal water-water reactor (VVER) of a nuclear power plant. The practical use of vibroacoustical diagnostics is shown in determining concrete defects and in estimating the general condition of the equipment in the primary loop at the Novo-Voronezh nuclear power plant by analyzing various reactor and equipment noises (structural, acoustical, neutron, and hydrodynamic). (tr-SJR)

2286 (INIS-mf-1702, pp 171-181) TESTING THE STEAM GENERATORS FOR NOVO-VORONEZH NUCLEAR POWER STATION. Kozlov, Yu. V.; Galetskii, N. S.; Grishakov, V. I.; Plotnikov, I. M.; Titov, V. F.; Ott, O. B.; Ryabov, G. A. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

A combined study of the thermal and separation characteristics is carried out on steam generators of the horizontal type in a B-440 assembly. Confirmation was carried out for specifications on steam saturation; the permissible water level in the steam generator was established, and a study was made of features of the hydrodynamic water flow over the heat exchanger tubes. Actual heat transfer coefficients were determined, and a study was made of the feed water heating conditions. From the experimental data it is possible to predict with greater accuracy the separation and thermal-hydraulic data on steam generators of this type. (tr-SJR)

2287 (INIS-mf-1702, pp 182-193) OPERATING EXPERIENCE OF THE NOVO-VORONEZH NUCLEAR POWER STATION. Ovchinnikov, F. Ya.; Sedov, V. K.; Golubev, L. I.; Skrypnikov, V. I. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

Operating problems in reactors at the Novo-Voronezh nuclear power plant are reviewed. A look is taken at the use of a liquid neutron absorber of boric acid in order to compensate for excess reactivity and to equalize power over the volume of the active zone. A look is taken at the operation of the basic equipment in the primary loop and problems of improving this equipment. Data of the effect of the power reactor on the environment, and basic operating parameters are presented. (tr-SJR)

2288 (INIS-mf-1703, pp 3-15) IN-PILE EXPERIMENTS IN THERMAL AND PHYSICAL CHARACTERISTICS OF URANIUM DIOXIDE FUEL ELEMENTS. Spiridonov, Yu. G.; Tsykanov,

V. A.; Fomin, N. A.; Samsonov, B. V.; Aban'kin, A. K. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

A description is given of the technique and results of experiments in determining the thermal conductivity of uranium dioxide and the magnitude of the contact conductivity of the gap between the fuel and cladding of a fuel rod directly during irradiation in a reactor. The method of determining these parameters is based on using a solution of the steady-state equation of the thermal conductivity of a finite cylindrical rod having internal sources of heat. The data are recommended for thermal-physical calculations of reactor fuel rods of the type VVER-440 and VVER-1000. (tr-SJR)

2289 (INIS-mf-1703, pp 113-124) INTEGRAL WATER-COOLED-WATER MODERATED REACTORS WITH FREE CIRCULATION OF COOLANT: AN ADVANCED NUCLEAR POWER PLANT. Kotov, A. P.; Marinich, A. M.; Paramonov, P. M.; Selivanov, V. M.; Sergeev, Yu. A. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

The basic principles used in developing integral, nuclear steam generators of low power in water-water reactors operating with natural circulation of the coolant are described. These steam generators are intended for use in remote regions of the country. In addition, on the basis of design studies a look is taken at the possibility of creating this type of steam generators with standardized design for use with large nuclear power reactors (500 megawatt-electrical and higher). Methods are discussed for further improving steam generators of this type. (tr-SJR)

2290 (INIS-mf-1703, pp 125-138) SOME PROBLEMS IN OPTIMIZATION OF A FABRICATION TECHNIQUE FOR URANIUM DIOXIDE FUEL ELEMENTS FOR WWER AND BN REACTORS. Golovnin, I. S.; Kalashnikov, V. V.; Kushakovskii, V. I.; Obraztsov, I. T.; Sytov, L. I. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

The basic parameters of Soviet power reactors of the thermal water-water type (VVER) and of fast neutron reactors with a sodium metal coolant (BN) are described. For UO_2 fuel rods in these types of reactors consideration is given to problems associated with selecting a rational, technological scheme of making the fuel. The advantages and drawbacks of various methods of forming the fuel rods are presented: pressing and vibratory densification of the powder directly in the cladding. Methods of sintering in various media are considered. A number of reactor test results are presented. On the basis of the material which is presented it is concluded that pressing of fuel rod elements from UO_2 with subsequent sintering of the fuel rod in hydrogen-containing media is suitable for large-scale production in the above types of fuel rods. The vibratory compaction of UO_2 powder directly in the cladding requires further study. (tr-SJR)

2291 (INIS-mf-1703, pp 319-331) EMERGENCY OPERATION OF INTEGRAL WATER-COOLED-WATER MODERATED REACTORS WITH FREE CIRCULATION OF COOLANT AND REACTOR SAFETY. Merzlikin, G. V.; Orekhov, Yu. I.; Sergeev, Yu. A. 1974. (In Russian).

From Jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

With nuclear steam generator ABV-1,5 as an example, a look is taken at the effect of details of the integral steam generators in water-water reactors having natural circulation of the coolant on the course of an accident and on fulfilling the requirements of safety. The unit ABV-1,5 of low power (14.5 MWatt/t) is made with two loops. The active zone of the reactor and the steam generator are placed in a single vessel. Coolant circulation in both loops of the steam generator is natural. The reactor operates in the self-controlled mode. A number of accidents are considered (pipe break, disconnecting the steam generator). It is concluded that certain features of the steam generator (integral construction and natural circulation) increase its reliability and safety. (tr-SJR)

2292 (VTT-YDI-11) METHOD OF CALCULATING BOUNDARY CONDITIONS AT THE SURFACE OF A CONTROL ASSEMBLY IN A VVER-TYPE REACTOR. Wasastjerna, F. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Feb 1974. 49p. Dep. NTIS (US Sales Only) $5.50.

A method of computing boundary conditions at the surface of a hexagonal flux trap control assembly is described. This method uses a diffusion program in the fast energy range and the collision probability program THERMOS-OTA in the thermal range. It is compared with two analytical methods. The possibility of using a diffusion program in the thermal range as well is found to deserve serious consideration. (auth)

2293 (VTT-YDI-13) XISPO: A ONE-DIMENSIONAL COMPUTER CODE FOR PWR XENON TRANSIENTS. Tiihonen, O. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Jun 1974. 44p. Dep. NTIS (US Sales Only) $5.25.

XISPO is a one-dimensional one-group simulation program for axial xenon oscillations. It has been constructed especially for the investigation of xenon transients in connection with power level changes during the normal operation of nuclear power stations. The computing procedure is a conventional one with an analytical integration of iodine and xenon equations over a relatively long time step. The nonlinear feedbacks due the fuel and coolant temperatures are included in the model. XISPO has been written in FORTRAN V for UNIVACK 1108 but the departures from FORTRAN IV have been minimized. 5 references. (auth)

2294 (VTT-YDI-14) HEXBU: A TWO-DIMENSIONAL CORE POWER DISTRIBUTION, BURNUP, AND FUEL MANAGEMENT CODE FOR HEXAGONAL FUEL ASSEMBLIES. Siltanen, P.; Teraevirta, R.; Anttila, M. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Oct 1974. 180p. Dep. NTIS (US Sales Only) $12.00.

HEXBU is a two-dimensional core power distribution and burnup program with flexible fuel management capabilities. It is designed for PWR cores with hexagonal fuel assembly geometry. One- or two-group diffusion equation is solved applying a coarse mesh method, which combined features of nodal and finite-element methods. The program includes descriptions for various feedback and other effects. Nontrivial methods are employed in integrating fuel assembly burnups to allow fairly long burnup steps to be taken. The fuel management capabilities of the program include simulating various fueling operations as loading and removing of fuel assemblies to new core positions. Intermediate storing of fuel assemblies is also possible. Except for one timing subroutine HEXBU is written in FORTRAN V for UNIVAC 1108 computer. (auth)

2295 (VTT-YDI-15) INVENTORIES OF STABLE FISSION GASES AND RADIOLOGICALLY MOST IMPORTANT RADIOACTIVE FISSION PRODUCTS IN THE CORE OF A PRESSURIZED WATER REACTOR. Mattila, L. J.; Stengard, J. O. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Jan 1975. 18p. Dep. NTIS (US Sales Only) $4.00.

As a part of the analysis concerning radiological consequences of a major LWR accident, specially LOCA, inventories of the most significant radioactive nuclides (certain isotopes of iodine, xenon, cesium, strontium, ruthenium and tellurium) and stable fission gases in the core of a PWR type reactor have been calculated. Calculations were performed by the CINDER code using recent nuclide data and neutron flux data obtained earlier by the METHUSELAH code. Certain CINDER results were compared to published calculations and good correlation was found. 6 references. (auth)

2296 NUCLEAR FUEL OF THE NOVO VORONEZH NUCLEAR POWER PLANT REACTORS. Prokopova, L.; Prokop, K. Jad. Energ.; 20: No. 9, 320-322(Sep 1974). (In Czech).

Listed are the properties of fuel element materials and the characteristics of fuel elements, of fuel and control assemblies of the WWER-210, WWER-365 and WWER-440 reactors. (INIS)

2297 CORE INTERNALS OF PRESSURIZED WATER REACTORS. Tech. Rev., Mitsubishi Heavy Ind.; 11: No. 3, 260-262 (1974).

The functional requirements of the core and its components are discussed together with the materials commonly used in core internals. (DG)

2298 PROBLEM OF RELIABILITY OF STEAM GENERATORS AT NUCLEAR POWER STATIONS WITH WATER-MODERATED WATER-COOLED REACTORS. Styrikovich, M. A.; Margulova, T. Kh. (Inst. of High Temperatures, Moscow). Therm. Eng.; 21: No. 9, 76-79(Sep 1974).

Translated from Teploenergetika; 21: No. 9, 55-57(Sep 1974).

Design and operation of PWR steam generators are discussed with regard to failures resulting from corrosion. The effects of sludge in the steam generator are examined, and the design approaches for minimizing this problem are illustrated. (DG)

2299 ANALYSIS OF NEUTRON-DENSITY OSCILLATIONS RESULTING FROM CORE BARREL MOTION IN A PWR NUCLEAR POWER PLANT. Fry, D. N.; Kryter, R. C.; Robinson, J. C. (Oak Ridge National Lab., TN). Ann. Nucl. Energy; 2: 341-351 (1975).

Neutron noise signatures were obtained on August 3, 1973, that were due to abnormal movement of the core barrel at the Palisades Nuclear Plant. Frequency spectra, rms noise, and amplitude probability density were recorded as sensed by ex-core and in-core neutron detectors. These signatures will serve as reference data for future studies of core-barrel motion at the Palisades plant. Also, the results are presented in units that should make them useful for noise diagnosis in other pressurized water reactors. (auth)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 2353, 2449, 2450, and 2519.

2300 (DEU-75-22) CONCEPT OF THE HIGH-TEMPERATURE REACTOR FOR THE EARLY INTRODUCTION OF NUCLEAR PROCESS HEAT INTO THE MARKET. (Hochtemperatur-Reaktorbau G.m.b.H., Koeln (F. R. Germany)). Jan 1974. 47p. (In German). INIS.

Technical and economical aspects of the introduction of nuclear process heat into the market are reported, and questions of rentability are discussed with regard to the price development in the electric power industry and the SNG costs in coal gasification. Structure and core design of a 2,000 MW(t) reactor plant for process heat production are described, and the expected fission product release is estimated. (GE)

2301 (GA-LTR-9(Suppl.1)(Amend.2)) THERMAL CONDUCTIVITY OF LARGE HTGR FUEL RODS. (General Atomic Co., San Diego, Calif. (USA)). 26 Sep 1975. 45p. General Atomic Co., San Diego, CA.

Supplemental information is presented concerning fuel rod thermal conductivity and temperature distribution and thermal conductivity of graphite shim material. (DG)

2302 (INIS-mf-1702, pp 24-32) FIRST ATOMIC POWER STATION OPERATING EXPERIENCE DURING 20 YEARS. Kuznetsov, V. A.; Ovechkin, D. M.; Sever'yanov, V. S.; Tregubov, V. B.; Chistilin, A. V. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

The basic operational stages are described in the nuclear power plant at Obninsk, USSR: construction, assembly and startup of the plant; operation in the power mode and power transmission; the beginning of experimental studies and gradual transition to use of the reactor in the research mode. A brief presentation is given of the main features of scientific developments in improving uranium-graphite reactors of the channel type. (tr-SJR)

2303 (INIS-mf-1702, pp 149-170) NUCLEAR SUPERHEATING IN PRESSURE TUBE REACTORS: SOME RESULTS AND PROSPECTS. Dollezhal, N. A.; Aleshchenkov, P. I.; Baturov, B. B.; Mityaev, Yu. I. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

After a short history of the development of nuclear superheating in the USSR and enunciation of the main principles used in designing the Beloyarsk Nuclear Power Plant (BAES), the main features in the ten-year development of both reactors at this site are presented. (tr-SJR)

2304 (INIS-mf-1703, pp 99-112) POWER UNITS WITH NUCLEAR REACTORS FOR SUBCRITICAL AND SUPERCRITICAL STEAM PARAMETERS FOR OPERATION UNDER SEMIPEAK LOADS IN AN ENERGY SYSTEM. Aleshchenkov, P. I.; Bakanov, A. V.; Zvereva, G. A. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

As a result of estimating the coverage of future loads on electrical power systems in the European part of the Soviet Union it was established that 40 to 50% of the load will fall on peak and semi-peaking facilities which will be forced to operate with highly variable loadings. The possibilities are analyzed of creating semi-peaking facilities based on uranium-graphite reactors with various fuel schemes. A comparison is presented of economic indices of semi-peaking facilities based on nuclear fuel with economic indices of proposed semi-peaking facilities based on organic fuel and with the economic indices of base nuclear facilities. (tr-SJR)

2305 (INIS-mf-1703, pp 233-246) 2000 MWt(e) MODULAR PRESSURE-TUBE REACTOR WITH NUCLEAR SUPERHEATING. Dollezhal, N. A.; Emel'yanov, I. Ya.; Bulkin, Yu. M. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

A look is taken at the advantages of features of the uranium-graphite, channel reactor having a power of 2 million kilowatts with nuclear steam superheating and a rectangular active zone, which is a further development of the RBM-K type of reactor. A description is given of a cross-sectioned cut of the reactor, its thermal scheme, and the basic technical and neutron characteristics. The possibility of assembling this reactor in the near future is stressed. (tr-SJR)

2306 (INIS-mf-1703, pp 269-287) SAFE OPERATION OF NUCLEAR POWER PLANTS WITH A URANIUM-GRAPHITE REACTOR IN CASE OF EQUIPMENT FAILURES. Emel'yanov, I. Ya.; Rybakov, N. Z.; Gavrilov, P. A. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

A study is presented of the conditions for safe operation of a uranium-graphite reactor of the RBM-K type in the transient and accidental modes occurring in case of equipment failure (of the main circulating pumps, the feed pumps or the turbogenerator) and taking the unit off the power system. (tr-SJR)

2307 (JUL-1155) INFLUENCE OF WALL MATERIALS ON Cs DEPOSITIONS IN HTR COOLANT LOOPS. Herion, J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Grenzflaechenforschung und Vakuumphysik). Jan 1975. 67p. (In German). INIS.

The basic concepts on the effect of the wall material on the deposition of fission products in high temperature reactor (HTR) coolant loops are developed which include the mechanisms of adsorption, solubility and diffusion. General mathematical interrelations of the Cs-adsorption on technical metals are presented and discussed using experimental data from the literature. Desorption energies and frequency factors are determined from measurements of the electrons' work function of metals in Cs atmosphere from R. G. Wilson using these mathematical interrelations. (GE)

2308 (JUL-1177) CONTRIBUTION TO THE THEORETICAL INTERPRETATION OF REACTIVITY MEASUREMENTS. The Critical HTR-Experiment KAHTER as a Test Example. Gerwin, H.; Scherer, W. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Reaktorentwicklung). Mar 1975. 46p. (In German). Dep. NTIS (US Sales Only) $5.50.

For control and improvement of theoretical methods to determine the control-rod efficiencies in high temperature reactors, comparisons with experiments are necessary. Thereby the question arises regarding the precision of such a comparison because of the differences of measurement and evaluation methods. The kinetic equations are analysed, based on the diffusion theory. Their application to interpret different usual methods of reactivity measurement is presented. It is shown that the reactor is disturbed in its dynamic behavior by the measurement methods. A direct mathematical simulation of the experimental methods thus seems to be necessary for the precise examination of the calculation models. Using a selected example of the critical experiment KAHTER, it is shown that an exact valuation of theoretical models is then possible with the aid of experimental results. (auth)

2309 (JUL-1197) MEASUREMENT OF FISSION GASES RELEASED FROM HTR IRRADIATION PROBES IN THE BR-2 AT MOL, BELGIUM. Koetter, H.; Mueller, H. B. (Kernfors-

chungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralabteilung Brennelement- und Bestrahlungstechnologie). Apr 1975. 34p. (In German). Dep. NTIS (US Sales Only) $4.75.

During the irradiation of HTR test fuel (coated particles resp. compacts) the release rate of fission gases is measured automatically. For that purpose the γ-spectrum of the sweep gas is analyzed with respect to the isotopes Xe-133, Xe-135, Xe-135^{m}, Xe-137, Xe-138, Kr-85^{m}, Kr-87, Kr-88, Kr-89. Gas sampling, spectral analysis, data handling and evaluation are controlled by computer. 5 references. (auth)

2310 (RD/B/N-1266) METHODS OF DETECTING MASSIVE FUEL CLADDING FAILURES IN MAGNOX REACTORS. Burton, L. K.; Davies, B. S. J.; Gayton, F. M.; Hall, J. A.; Rodliffe, R. S.; Wilkins, K. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Nov 1969. 23p. Dep. NTIS (US Sales Only) $4.25.

Methods of protecting a magnox reactor against channel melt-out due to a single can failure are considered. It is concluded that the most promising system would be to monitor the top ducts of steel pressure vessel reactors for delayed neutrons. Experimental measurements at Berkeley Power Station show that delayed neutrons from uranium contamination of the fuel elements may be detected. 10 references. (auth)

2311 RESONANCE INTEGRAL OF COATED PARTICLES. Tsuchihashi, K.; Gotoh, Y. (Japan Atomic Energy Research Inst., Tokai). Nucl. Sci. Eng.; 58: No. 2, 213-225(Oct 1975).

The effective resonance absorption of coated particles, which are embedded in a graphite matrix, is studied. The effect of a random arrangement of particles on the resonance integral is examined using the radial distribution function derived from the Percus-Yevick equation. A differential equation is proposed to obtain the neutron-beam current from a source particle in a medium in which the distribution function of coated particles is specified. By the use of the neutron beam current and the distribution function as the weight, the fuel-to-fuel collision probability is defined. This collision probability is applied to a RICM-type resonance integral code. The depression of the resonance integral of ^{238}U due to grain structure amounts to 5 percent in a design study of the multi-purpose high-temperature gas-cooled reactor (HTGCR) at the Japan Atomic Energy Research Institute. The applicabilities of the spherical cell model and of the collision probability in the high-dilution approximation of Lane et al. are tested. These simple procedures give satisfactory results for the treatment of microscopic heterogeneity in the range of the HTGCR design. (auth)

2312 HTGR CONTAINMENT VENTILATION SYSTEMS. Krane, P. M. (General Atomic Co., San Diego, CA). Heat., Piping Air Cond.; 47: No. 10, 48-51(Sep 1975).

2313 NUCLEAR POWER INSTALLATIONS. George, B. V. (to British Nuclear Design and Construction Ltd.). British Patent 1,391,987. 23 Apr 1975. Filed date 12 Apr 1972. 5p.

Reference is made to gas cooled nuclear power installations. In such installations it may be advantageous to drive the coolant circulators by means of steam turbines, and an arrangement for this is described. (UK)

2314 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR PRESSURE VESSELS. Cook, R. K.; Smith, N. C. (to British Nuclear Design and Construction Ltd.). British Patent 1,388,860. 26 Mar 1975. Filed date 19 Nov 1971. 5p.

An invention is described which relates to the method of securing thermal insulating material to the internal surfaces of gas-cooled nuclear reactor pressure vessels. Metal cover plates, secured by mounting studs, hold insulating material against the metallic lining membrane of the concrete pressure vessel. The object of the described invention is to provide secondary retaining links in case of failure of the studs. By these links each cover plate is attached to a number of other adjacent cover plates. The links have a degree of flexibility sufficient to accommodate, without undue thermally-induced stresses being imposed on the cover plates, studs or links, the thermally-induced displacements which will occur between linked parts of mutually adjacent cover plates. (UK)

2315 CIVIL ENGINEERING ASPECTS OF HEYSHAM NUCLEAR POWER STATION. O'Connor, K. A. (Central Electricity Generating Board, London). Proc. Inst. Civil Eng. (London); 58: 377-393(Aug 1975).

The various stages in the construction of the power station integrated building are described. The methods adopted to control groundwater during the construction of the prestressed concrete reactor pressure vessel foundations and to limit consequential reactor settlement are discussed. The use of the main building elements and early setting to work of permanent cranes to assist in handling large prefabricated building and reactor components are illustrated. The critical path in the construction of the reactor and the interrelation between civil and mechanical key events on this path are described in detail. Reference is made to the circulating water system and how harbor civil works built at the turn of the century are being incorporated in the intake structure. (auth)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstracts 2279, 2504, and 2517.

2316 (AECL-5036) GUIDE TO LATREP (1975). Milgram, M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Mar 1975. 63p. Dep. NTIS (US Sales Only) $6.25.

Since the last LATREP manual (LM-1) was issued in 1970, the LATREP program has been modified and corrected in many ways. The result of this development effort is the new CYCLE 4 version of LATREP which was made available on the CDC-6600 computer at CRNL in June 1974. At about the same time, active development of the older CYCLE 3 version of the program ceased. This report serves the following purposes: to briefly describe changes made to LATREP (CYCLE 3) since LM-1 was issued; to describe the differences between CYCLE 3 LATREP and CYCLE 4 LATREP; and to be a guide to the use of the TESHOM program which prepares input for both versions of LATREP. 12 references. (auth)

2317 (INIS-mf-1702, pp 274-284) HEAVY-WATER REACTORS IN NUCLEAR POWER ENGINEERING. Il'ichev, B. I. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

The characteristics of heavy-water reactors are presented for the rapid production of plutonium, for rapid breeding and for the economic use of the spent material from enriched uranium fuel. It is shown that by means of heavy-water reactors it is possible to increase substantially (for example, by a factor of two) the rate of introduction of fast-neutron, breeder reactors. The effect of using spent material on the heavy-water reactors is evaluated. With a uranium-235 content in the spent material, for example, of 3 kg per metric ton, by operating in the "plutonium-catalyst" mode in a heavy-water reactor it is possible to generate from one metric ton of spent fuel the same amount of electrical energy as would be obtained from one metric ton of natural uranium in a reactor operating on enriched uranium. (tr-SJR)

2318 NATURAL-URANIUM HEAVY-WATER REACTORS. McIntyre, H. C. Sci. Am.; 233: No. 4, 17-27(Oct 1975).

Design characteristics and economic aspects of CANDU, PWR, and BWR type reactors are compared. The development of the Canadian CANDU reactor system is reviewed. (DCC)

Power Reactors, Breeding

Refer also to abstracts 809, 1179, 2290, 2426, and 2436.

2319 (ANL-CT--76-06) PRELIMINARY STUDIES ON DYNAMICS OF BEAM/STOP IMPACT: NUMERICAL ANALYSIS. Shin, Y. S.; Sass, D. E.; Wambsganss, M. W. (Argonne National Lab., Ill. (USA)). Aug 1975. 64p. AT.

The relatively small, inherent tube-to-baffle hole clearances associated with manufacturing tolerances in heat exchangers affect the vibrational characteristics and response of the tubes. To gain insight into the basic dynamic behavior of tube/baffle impact, a numerical analysis of a uniform, cantilevered beam with motion-limiting stops at the free end was performed and is presented herein. A computer program has been written to compute the dynamic response time histories of the beam, including viscous damping and dynamic loads along the beam. Results indicate that the higher mode contributions are significant and, consequently, that a single-mode approximation for dynamic response may not be valid. (auth)

2320 (ANL-Trans-989) FAST NEUTRON REACTORS. Denielou, G.; Vautrey, L. Translated from Recherche (Paris); 4: No. 31, 143-153(Feb 1973). 41p. Dep. NTIS $5.25.

The principles of fast breeder reactor are recalled, and the advantages that they present are discussed. In most present day

reactors Na is used as the coolant fluid, mixed UO_2–PuO_2 oxide as the fuel, and ^{238}U in the form of UO_2 as the fertile material. (FR)

2321 (CONF-751101-7) DESIGN AND OPTIMIZATION OF FISSION COUNTERS FOR OPERATION AT HIGH GAMMA DOSE RATES. Pare, V. K. (Oak Ridge National Lab., Tenn. (USA)). 1975. 6p. Dep. NTIS $4.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

A systems engineering approach to the design of a counter-channel system is described. The theory involved is briefly summarized, and the design procedures are described. (DG)

2322 (ERDA-46) ADVANCED NUCLEAR REACTORS: AN INTRODUCTION. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Sep 1975. 28p. Dep. NTIS $4.00.

The advanced nuclear reactors being developed by the ERDA Division of Reactor Research are described. The need for advanced reactors is discussed and the priority of the LMFBR program is emphasized. (JWR)

2323 (EURFNR-1228) FISSION GAS BEHAVIOR IN OXIDE FUEL ELEMENTS FOR FAST BREEDER REACTORS. Zimmermann, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Oct 1974. Translation of KFK-2057, 48p. Dep. NTIS $5.00.

Work performed under United States-Euratom Fast Reactor Exchange Program.

The fission gas behavior in oxide fuel elements irradiated within the irradiation programme of the fast breeder project at the Karlsruhe Nuclear Research Center is reported and discussed. The amount of fission gas was measured in 3 steps as released fission gas, fission gas retained in bubbles and pores, and fission gas retained in very small intragranular bubbles and crystal lattice sites. This was done by piercing the fuel rods, by grinding the fuel, and by chemical solution of the powdered fuel, respectively. Under the conditions prevailing in fast breeder reactors the fractional fission gas release is about 90 percent or more after medium and high burnups. The release rate is not constant, but there are periods with high release rates (break away releases). A simple formula describing fission gas release rates in 3 temperature regions was obtained on the basis of measured release rates and concentrations of the retained fission gas. (34 references) (auth)

2324 (GA-A-13238) GAS-COOLED FAST BREEDER REACTOR. Quarterly Progress Report, August 1, 1974–October 31, 1974. (General Atomic Co., San Diego, Calif. (USA)). 12 Dec 1974. Contract AT(04-3)-167. 204p. Dep. NTIS $7.60.

The tasks of the Gas-Cooled Fast Breeder Reactor (GCFR) program include: development of GCFR fuel, blanket, and control elements; fuels and materials development; nuclear analysis and reactor physics for GCFR core design; development of the pressure-equalization system for fuel; structural-thermal-flow tests of core assemblies; an in-pile loop facility test program plan; reactor engineering to assess the thermal, hydraulic, and structural performance of the core and core support structure, to evaluate and develop the reactor control-rod, shutdown-rod, and core components locking mechanisms, and to evaluate the capability of PCRV internal structures to serve as postaccident fuel containment; to evaluate the pressure-boundary integrity of the prestressed concrete reactor vessel (PCRV); reactor safety; refueling-system development; component development engineering, in particular, the steam generator, helium circulator, and PCRV; shielding requirements of the GCFR; and fuel-rod engineering to evaluate the steady-state and transient performance of the GCFR fuel and blanket rods. (auth)

2325 (GEAP--13825-13) INSTRUMENTATION DEVELOPMENT THIRTEENTH QUARTERLY REPORT, JANUARY--MARCH 1975. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). May 1975. Contract AT(04-3)-893. 36p. AT.

The development of instrumentation for surveillance of the core and in-vessel components of liquid metal fast breeder reactors is reviewed. Current development efforts are focused on high temperature neutron detectors and advanced signal transmission methods. 7 references (auth)

2326 (GEAP--13993(Rev.1)) PECS-II: A COMPUTER PROGRAM FOR THE PROBABILISTIC EVALUATION OF FUEL ROD FAILURE CAUSED BY FISSION GAS PRESSURE. Temme, M. I.; Atcheson, D. B.; Feerick, B. T. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Jun 1975. Contract AT(04-3)-893. 208p. AT.

The PECS-II (Probabilistic Evaluation of Cladding Stress) computer program is described, along with instructions for its use. Monte Carlo simulation is used to calculate probability distributions for LMFBR cladding failure caused by fission gas pressure. The entire reactor core is simulated by dividing the core into groups of fuel rods with similar operating conditions. Importance sampling is applied in order to reduce the number of Monte Carlo samples (and the cost) required for adequate estimation of low values of probability. PECS-II is operational on the Honeywell-6000 computer and the CDC-7600 computer. (auth)

2327 (GEAP--14031-3) CORE RESTRAINT ENGINEERING THIRD QUARTERLY REPORT, FEBRUARY--APRIL 1975. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Jun 1975. Contract AT(04-3)-893. 22p. AT.

Core restraint system design requirements, subcomponents, and analytical methods in accordance with LMFBR Program Plant Task 6-216-1, 6-216-2, and 6-216-3 are presented. Progress during February, March, and April 1975 is described for subtasks related to withdrawal force testing, transient analysis, load pad and channel wall lateral limits, in-reactor load pad surveillance, and withdrawal force minimizer. (auth)

2328 (INIS-mf-1702, pp 194-205) FAST REACTOR DEVELOPMENT IN THE USSR. Kazachkovskii, O. D. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

This study considers the development history of fast reactors in the USSR beginning from 1943. Basic parameters are presented for the physics reactors VR-1, VR-2, VFS-1 and VFS-2, on which studies were conducted of the basic problems of fast neutron reactor physics. The basic parameters are presented for reactors BR-5 and BOR-60, and also for the experimental, demonstration reactors BN-350 and BN-600. (tr-SJR)

2329 (INIS-mf-1702, pp 262-273) PHYSICAL, TECHNICAL, AND ECONOMIC PARAMETERS OF NUCLEAR POWER PLANTS WITH FAST REACTORS USING DISSOCIATING NITROGEN TETROXIDE AS A COOLANT. Krasin, A. K.; Nesterenko, V. B.; Bubnov, V. P.; Naumov, V. A.; Slizov, V. P.; Tverkovkin, B. E.; Mirgorodskii, V. S.; Nesterenko, I. E.; Kovalev, S. D. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

On the basis of using the physical-chemical properties of the coolant, the thermal-physical characteristics, the combination of theoretical and experimental studies on heat exchange, coolant technology, analysis of thermal schemes and equipment parameters it is shown that it is possible to create a single-loop, fast neutron, gas-cooled reactor having a power of 1000 to 1500 megawatts (electrical). Data are presented on design calculations for a number of variants. The basic physical characteristics of the reactors are a breeding coefficient of 1.46 to 2.0 and a doubling time of 3 to 5.4 years. The paper presents an example of the possibility of developing nuclear power up to the year 2000 by bringing fast neutron reactors on stream. (tr-SJR)

2330 (INIS-mf-1703, pp 154-165) SOME PROBLEMS IN FAST REACTOR ECONOMICS. Mekhov, N. V.; Gerasimov, V. N.; Zavadskii, M. I. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

The outlook for the development of fast neutron power reactors and their competitiveness depend on technical and economical parameters. This paper considers a number of economical parameters of fast neutron power reactors (capital expenditures and the operating costs of producing electrical energy). Formulas are presented for determining the specific capital costs required to construct fast neutron power reactors. An attempt is made to justify the distribution of fuel reprocessing plants using spent fuel rods from fast neutron reactors. (tr-SJR)

2331 (NEANDC(E)-163U, pp 19-42) IMPORTANCE OF RESONANCE PARAMETERS OF FERTILE NUCLEI AND OF ^{239}Pu ISOTOPE FOR FAST POWER REACTORS. Barre, J. Y.; Khairallah, A. Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

The importance of resonance parameters is discussed for fertile nuclei and ^{239}Pu isotope used in PuO_2-UO_2 fueled LMFBR type reactors with a power range of 200 to 2000 MW(e). The determination of self-shielding factors is analyzed. The sensitivity of self-shielding factors to resonance parameters is described. The main design parameters related to the amplitude of self-shielding factors are considered. The analysis presented is based on the Cadarache multigroup cross section set and code CARNAVAL Version 3 and the CEA fast reactor physics program. (auth)

2332 (RCN-227) NUMERICAL CALCULATION OF TEMPERATURE FIELDS IN ROD ASSEMBLIES WITH LIQUID METAL COOLING. Slagter, W.; Roodbergen, H. A. (Stichting Reactor Centrum Nederland, Petten). Jul 1975. 34p. Dep. NTIS (US Sales Only) $4.75.

A numerical method has been applied to determine three-dimensional temperature distributions in small regions of hexagonal fuel rod assemblies with liquid metal cooling. The temperature calculations, based on the finite element method, centered on heat transport from the fuel rod surface into the adjacent subchannel and on heat transport between adjacent subchannels. The study is restricted to analysis of steady-state heat transfer in fuel rod assemblies of smooth parallel rods for the condition of prescribed heat flux and slug flow. The computed temperature profiles are expressed in terms of Nusselt or Stanton numbers and amplitudes of circumferential cladding temperature variations as a function of axial distances. In simple geometries like the circular duct, the method is applied to calculate the temperature distribution and the axial variation of the Nusselt number for the condition of laminar flow and uniform heat flux. The flow is hydrodynamically developed. The good agreement between numerical and theoretical solutions confirms the validity of the finite element method. The results obtained for fuel rod assemblies are compared with available experimental and theoretical predictions. It is found that the contribution of turbulence to intersubchannel heat transport in sodium equals that due to conduction. The novel feature of the method applied to convective heat transfer problems is the computation of detailed three-dimensional coolant temperature fields in large regions of fuel rod assemblies. (auth)

2333 (WARD-NA-3045-22) INTERSTITIAL TRANSFER PROGRAM: ITF RUNS 2 AND 3. Shiels, S. A.; Bagnall, C.; Orbon, S. J.; Schrock, S. L. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Jul 1975. Contract E(11-1)-3045. 70p. AT.

The Interstitial Transfer Facility (ITF) is a sodium loop designed to simulate the interstitial transfer of C and N in stainless steel components in the FFTF primary system. The ITF design is discussed and the background to the test program is given. Results are reported for the first two test runs, ITF-2 and -3, which were an attempt to apply the CEL carbon transfer predictions to a heat transfer system. (DLC)

2334 DEVELOPMENT OF EXPERIMENTAL SODIUM LOOPS. Pasek, M. Nukleon.; No. 2, 39-46(Sep 1974). (In Czech).

A brief survey is given of experimental sodium loops built at the Institute of Nuclear Research at Řež, designed for research of sodium as a fast reactor coolant. (INIS)

2335 ON THE NECESSITY FOR BREEDER REACTORS. Kohl, H. K.; Sarlos, G.; Seifritz, W. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Neue Tech.; 16: No. 9, 343-350(Sep 1974). (In German).

The necessity of the introduction of breeder reactors results from the fuel shortage and from the presumed increase in fuel prices for light water reactors in the future. Without the introduction of breeder reactors the uranium mining and the needed separative work capacity would increase enormously. Good breeder reactors are able to extend the uranium and thorium reserves and to guarantee the fuel supply for a long time. At the moment the gas cooled fast reactor—which is in its development behind the sodium cooled fast reactor—seems to have a better breeding rate than the sodium cooled reactor. In the future, for a maximum independence the former provides a more favorable ratio of breeder to burner reactors. (auth)

2336 SUB-ASSEMBLY FOR NUCLEAR POWER PLANT. Leigh, D. G. (to Clarke Chapman Ltd.). British Patent 1,389,134. 3 Apr 1975. Filed date 4 Jul 1972. 5p.

It is stated that many factors have to be taken into account in the design of those parts of a nuclear reactor known as the "diagrid" and the "diagrid vessel", and particularly the design of welding joints between components. Welds exposed to arduous conditions must be capable of being fully radiographed. Another factor is to reduce as far as possible passages through the wall of the diagrid vessel, which supports the reactor core. In a liquid metal cooled reactor the diagrid carries columnar "leaning posts", each located at the center of a group of fuel element assemblies carried by the diagrid. These "leaning posts" give lateral support for the fuel element assemblies in the group. Another requirement is the balancing of forces acting on the fuel element assemblies owing to the difference in pressure between high pressure and low pressure liquid coolant. The object of the arrangement described is to meet these requirements. Full constructional details are given. (UK)

2337 SUPER PHENIX. First Commercial Plant of the Fast Breeder Line. Carle, R. (Cen de Saclay, Gif-sur-Yvette, France). J. Br. Nucl. Energy Soc.; 14: No. 3, 183-189(Jul 1975).

From British Nuclear Energy Society meeting; Risley, Eng. (12 Feb 1975).

Planning and commissioning of the Phenix fast reactor demonstration plant are outlined and a cost estimate is shown. Operating experiences during the first months are described. The modifications which were adopted for the 1100 MW(e) Super Phenix, which is to be the first commercial breeder plant, are discussed and details are given of its basic features. Safety and cost aspects of Super Phenix are also discussed and a brief indication is given of the industries and organizations involved in the project. (UK)

2338 MODELLING OF CAVITATION INCEPTION. Baum, M. R.; Cook, M. E. (Central Electricity Generating Board, Berkeley, Eng.). J. Br. Nucl. Energy Soc.; 53: No. 2, 131-135 (Apr 1975).

In the coolant circuits of fast reactors it is desirable to minimize or, if possible, to eliminate cavitation. As it is not yet possible to predict confidently, from first principles, the conditions under which cavitation will occur, model testing is employed to develop cavitation-free components. Where gas bubbles entrained in the flow are the main source of cavitation nuclei, the use of small scale models to investigate cavitation inception can generate a situation where the period of the pressure changes experienced by the entrained bubbles is similar to or less than their natural period of oscillation. Under such conditions the bubbles no longer remain in thermal and mechanical equilibrium with the surrounding liquid and cavitation inception in the small-scale model is no longer representative of what happens in the full-scale component. (UK)

2339 PRESSURE VESSEL WALL THICKNESS LIMITS BASED ON THERMAL STRESS RATCHETTING AND CREEP FATIGUE INTERACTION. Minami, H. M.; Veljovich, W. Paper No. 74-WA/PVP-11. New York; American Society of Mechanical Engineers (1974). 27p.

The severe thermal transients to which Liquid Metal Fast Breeder Reactor (LMFBR) piping and pressure vessels are subjected may induce high secondary and peak thermal stresses in the pressure boundaries. Since these stresses increase in a nonlinear fashion with wall thickness, the question arises as to the existence of an absolute thickness limit beyond which typical LMFBR plant transients induce stresses and strains which exceed the ASME Boiler and Pressure Vessel Code life and strain limits. To answer this question inelastic analyses of infinite cylinders, of various dia and wall thickness configurations, subjected to cyclic thermal transients and high-temperature hold times were performed. Since the approximate magnitude and duration of typical current LMFBR normal scram and emergency transients are known, the creep-fatigue damage and incremental strain/cycle were determined and these results were extrapolated to obtain the allowable number of such cycles which could be sustained without exceeding code allowable limits. The inelastic analyses were performed using a rigorous, but economical, finite-element computer program based on incremental flow law constitutive equations for creep and plastic strains. The analyses assumed kinematic hardening, as well as currently recommended cyclic strain hardening material behavior. Both primary and secondary creep rates were considered. The results of the investigation are presented in the form of design curves for use in conceptual design and feasibility studies. These results can be used to aid in obtaining early assurance that the stringent requirements of the ASME Code can be satisfied for piping and pressure vessels under transient thermal loads. (Metals Abstr.)

2340 TEMPERATURE NOISE MEASUREMENTS IN BLOCKED AND UNBLOCKED 19-PIN ELECTRICALLY HEATED LMFBR FUEL SUBASSEMBLY MOCKUPS. Fry, D. N. (Oak Ridge National Lab., TN). Ann. Nucl. Energy; 2: 233-234(1975).

Sodium temperature noise was measured at the exit of a simulated fast reactor fuel subassembly to determine the feasibility of

using temperature noise monitors to detect flow blockages in fast reactors, a matter of ever-increasing concern in the LMFBR program. Noise from both blocked and unblocked test bundles was characterized using various noise signal descriptors such as power spectral density, cross spectral density, amplitude probability distribution, and root mean square (rms). (auth)

2341 DYNAMIC HEAT TRANSFER EXPERIMENTS IN AN ELECTRICALLY HEATED LMFBR FUEL ELEMENT MOCKUP. Fry, D. N.; Kerlin, T. W.; Sides, W. H. (Oak Ridge National Lab., TN). Ann. Nucl. Energy; 2: 235-236(1975).

Experiments were performed at the Fuel Failure Mockup Facility to obtain data for use in determining heat transfer and flow paths in simulated LMFBR fuel bundles that were operated with and without flow blockages. The heat input to one rod of a 19-rod bundle was modulated, and the temperature responses were monitored with thermocouples at various positions in the bundle. The experimental data were processed to yield frequency responses for the measured thermocouple-heater pairs. The experimental results are discussed. (auth)

Research, Test, and Experimental Reactors

Refer also to abstracts 2416–2419, and 2454.

2342 (ANCR-1171) APPLICATION OF A REAL TIME STACK MONITOR USING A Ge(Li) DETECTOR AND A PDP-9 PROCESSOR. Nieschmidt, E. B.; Dyer, N. C.; Killian, E. W.; Coates, R. A. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Nov 1974. Contract AT(10-1)-1375. 26p. NTIS $4.00.

The growing number of nuclear reactors used for power generation has increased the need for rapid isotopic analysis of reactor system effluents. Described is a prototype stack monitor recently operated at the Advanced Test Reactor at the Idaho National Engineering Laboratory. This remotely operated system uses a 45 cu cm Ge(Li) detector and a 4096 channel multi-channel analyzer; data are processed by a PDP-9 computer. Data transmission and analyzer control is via commercial telephone and MODEM system. During a recent two week operating cycle the stack effluent was monitored. The more prominent isotopes observed include ^{88}Kr, ^{89}Kr, ^{89}Rb, ^{135}Xe and ^{138}Xe; numerous other isotopes were identified and quantified. The results of this monitoring, interpretation of the data and system operation are discussed. (GRA)

2343 (DEU-75-12) ANNUAL REPORT 1972. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1972. 184p. (In German). INIS.

The development of Geesthacht research centre, the research facilities (NS "Otto Hahn", FRG-1 and FRG-2, ANEX), research and development projects, cooperation with industry and other research facilities, as well as publications and lectures of 1972 are discussed. (GE)

2344 (DEU-75-13) ANNUAL REPORT 1973. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1973. 110p. (In German). INIS.

The GKSS scientific annual report summarizes the problems and results of the research and development projects of 1973. The annual report was extended by the paragraph "Financial Report 1973" in the chapter "Development of Geesthacht Research Centre." The financial report gives a survey of the financial transactions and the major operations of the year under review. (GE)

2345 (KFK-2149) WIROCO: FORTRAN COMPUTER PROGRAM FOR RADIAL AND AXIAL HEAT TRANSFER, RADIATION, AND RADIAL HEAT EXPANSION IN ROTATION-SYMMETRICAL SYSTEMS BY USE OF THE RELAXATION METHOD. Seitz, H. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Material- und Festkoerperforschung). May 1975. 77p. (In German). Dep. NTIS (US Sales Only) $7.00.

The WIROCO FORTRAN computer program is used for thermodynamics calculations of rotationally symmetrical systems and, for this reason, lends itself particularly well to the application in thermal design of in-pile rigs. The program uses the relaxation method of thermodynamics to calculate steady state temperature fields, taking into account radial and axial heat conduction, heat radiation, and radial thermal expansion. A description is given of the structure of the WIROCO computer program, in particular in the light of variable dimensioning of the field parameters. The description of the input data is followed by an example indicating the calculation of the temperature field for an in-pile rig. (auth)

2346 (ORNL-TM-5007) OAK RIDGE RESEARCH REACTOR QUARTERLY REPORT JANUARY, FEBRUARY, AND MARCH OF 1975. Hurt, S. S. III; Lance, E. D. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 43p. Dep. NTIS $4.00.

The ORR operated at an average power level of 29.7 MW for 84.9 percent of the time during January, February, and March of 1975. Thirty-three fuel elements were declared spent (52.6 percent average burnup) during the quarter, while sixteen new elements were placed in service. Four shim rod elements were retired from service at an average burnup of 64.6 percent. The reactor was shut down on eleven occasions, two of which were unscheduled. Two end-of-cycle shutdowns accounted for 89.5 percent of the total downtime. The remaining downtime was used principally for refueling and experiment work. Maintenance activities, both mechanical and instrument, were essentially routine in nature. Special tests or measurements completed during the quarter included: (1) reactivity measurement with fuel removed from core position E5, (2) reactivity measurement with an Al core piece containing MoO_3 capsules in core position E5, (3) partial flux mapping of core, (4) shim rod calibrations, and (5) visual inspection of poolside facility. (auth)

2347 MEASUREMENT BY THE USE OF TWO DETECTORS OF THE GENERATION TIMES OF NEUTRONS IN THE "CROCUS" REACTOR USING THE METHOD OF INTERVAL DISTRIBUTION. Haldy, P. A.; Chikouche, M. (Ecole Polytechnique, Lausanne (Switzerland). Lab. de Genie Atomique). Z. Angew. Math. Phys.; 25: No. 5, 694-697(25 Sep 1974). (In French).

From Swiss Physical Society spring meeting; Bern, Switzerland (26 Apr 1974).

It has been proposed to detect by means of a multi-channel analyzer the histogram of the time intervals separating the detection of an event by a first detector and its detection in a second detector. The analytical form of the function of distribution is calculated from the statistical theory of chain processes of Kolmogorov et al. and some measurements and results are stated. (INIS)

2348 REMOVAL AND STORAGE OF ULTRACOLD NEUTRONS FROM A REACTOR. Golikov, V. V.; Taran, Yu. V. (Joint Inst. of Nuclear Research, Dubna, USSR). Instrum. Exp. Tech.; 18: No. 1, 36-40(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 1, 41-44(1975).

A method is proposed for extracting ultracold neutrons from converters having a cut-off velocity comparable with the cut-off velocity of the transport neutron guide or even exceeding it. A strong magnetic field is generated in the region of the converter and decreases beyond its boundaries. On emerging from the field, the neutrons with the required direction of spin are moderated. A scheme is described for using the converter with the magnetic field as a shutter for the storage of neutrons. 12 references. (auth)

2349 DISMANTLING OF THE DIORIT REACTOR. Francioni, W.; Frick, U. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerelingen, Switzerland). Schweiz. Ver. Atomenerg., Bull.; No. 12, 1-7(Jun 1971). (In German).

A brief description of the dismantling of the DIORIT-1 core and the assembling of the DIORIT-2 core is presented. (DG)

2350 EXPERIMENTAL STUDY OF THE NEUTRON SPECTRUM AND THE RADIAL POWER DISTRIBUTION IN A FUEL ELEMENT IN THE ILLINOIS ADVANCED TRIGA REACTOR. Weaver, W. L. III. Urbana, IL; Univ. of Illinois (1975). 144p. University Microfilms Order No. 75-14,187.

Thesis (Ph. D.).

The neutron spectrum in the Illinois Advanced TRIGA Reactor was measured with a neutron crystal spectrometer in various locations in the reactor core with the reactor operating under various conditions. The neutron spectrum was found to be well represented by a Maxwell–Boltzmann distribution with neutron temperature T/sub n/ at low energies and a 1/E or slowing down distribution at energies up to 1.5 eV. The neutron temperature T/sub n/ was found to increase as the thermal temperature of the fuel elements adjacent to the beam tube increased and the height of the Maxwell–Boltzmann of the spectrum decreased with respect to the 1/E or slowing down flux as the fuel element temperatures increased. The fission heat source distribution in a fuel element was determined using the method described by Goodwin (1967). The results of the spectral and thermal measurements were found to be consistent with the model proposed to explain the large prompt negative temperature coefficient of the ZrH fuel material. (Diss. Abstr. Int., B)

2351 MEASUREMENT OF THE NEUTRON SPECTRUM OF A FAST CRITICAL ASSEMBLY USING PROTON RECOIL PROPORTIONAL COUNTING. Lozito, E. J. College Station, TX; Texas A and M Univ. (1974). 124p. University Microfilms Order No. 75-15,041.

Thesis (Ph. D.).

The central neutron spectrum of the Big Ten Critical Assembly, a cylindrical assembly with a 10 percent enriched uranium metal core surrounded by a depleted uranium metal reflector, has been measured between 32 keV and 1177 keV, using proton recoil proportional counting techniques. A cylindrical detector filled with hydrogen gas was used for measurements between 23 keV and 650 keV, and a methane filled detector was used between 228 keV and 2.6 MeV. Pulse shape discrimination techniques were used to separate proton recoil pulses from electron pulses resulting from gamma-ray interactions below 200 keV. All of the measurements were performed with the assembly at a reactivity of 37 cents below delayed critical. The neutron spectrum was determined from the recoil proton data by response function unfolding. The monoenergetic neutron response functions and the high energy corrections to the data were computed using Monte Carlo methods. Monoenergetic neutron measurements were carried out at the LASL high current Van De Graaff and the Cockcroft–Walton Accelerator in order to test the accuracy of the computed response functions. The results of the spectrum measurements are compared with a transport theory computation of the neutron spectrum using E.N.D.F./B-III cross-section sets. (Diss. Abstr. Int., B)

Production and Materials Testing and Processing Reactors

Refer also to abstracts 1417 and 2300.

2352 STUDY OF ZIRCONIUM ALLOY CORROSION PARAMETERS IN THE ADVANCED TEST REACTOR. Johnson, A. B. Jr. (Battelle Pacific Northwest Labs., Richland, WA); LeSurf, J. E.; Proebstle, R. A. pp 495-513 of Zirconium in Nuclear Applications. Philadelphia; American Society for Testing and Materials (1974).

The influence of nuclear radiation on zirconium alloy corrosion was studied in the Advanced Test Reactor (ATR). The loop used was new and therefore was free of fissionable contamination. The principal corrosion parameters were: alloy composition; flux level; metallurgical condition; oxygen concentration; and surface pretreatment. The results from the ATR loop paralleled previous results from the ETR G-7 loop, indicating that dissolved oxygen, rather than fissionable contamination, was the principal cause of accelerated corrosion in both systems. (auth)

2353 OXYGEN PRODUCTION WITH THE AID OF NUCLEAR HEAT USING THE BRIN'S METHOD. Quittek, C. Aachen; Technische Hochschule (1973). 94p. (In German). INIS.

Thesis.

In order to assess the application possibility of the Brin method to produce oxygen using nuclear process heat, the fundamentals of the $BaO-BaO_2-O_2$ system are compiled. Equilibrium equations are possible with the values found in the literature. The kinetics of the reaction is determined by the diffusion of oxygen in the solid phase. A process for the continuous production of oxygen is introduced and calculated. In order to investigate the influencing parameters of the process, a computer programme is used in which the whole plant is programmed. By using a process heat reactor with a power of 500 MW(t) and a helium exit temperature of 1,100°C, a maximum oxygen production of about 90,000 Nm^3/h can be achieved. (GE)

Propulsion and Package Reactors

Refer also to abstract 2376.

2354 (AD-61-180A) NERVA REMOTE HANDLING SYSTEM. Summary. (American Machine and Foundry Co., Greenwich, Conn.). 1961. 74p. Dep. NTIS $6.75.

Declassified 24 Sep 1975.

This proposal for the NERVA program covers the remote handling system for the rocket engine. A summary of the AMF preliminary design, program plan, related experience, and facilities is presented. In planning the NERVA remote handling system, safety and reliability were paramount considerations. With these in mind, the remote handling system was then evolved using three basic criteria or guide lines. The system was developed as a function of time, usefulness, and cost. Basically, the NERVA remote handling system encompasses three principal areas to which AMF's systems planning is applied. These areas are: machinery for remote assembly, disassembly and maintenance operations; buildings or facilities in which to carry out these operations; and special purpose vehicles to provide for immediate action in the event of an engine malfunction. (auth)

2355 (AD/A-003457) SURVEILLANCE PROGRAM FINDINGS FOR ARMY MH-1A REACTOR AT END OF CORE 3. Hawthorne, J. R.; Serpan, C. Z. Jr.; Watson, H. E. (Naval Research Lab., Washington, D. D. (USA)). Nov 1974. 17p. (NRL-MR-2924). NTIS $3.25.

Charpy-V and tensile test results for five surveillance capsules removed from accelerated exposure, vessel wall, and above-core locations in the Army MH-1A reactor are presented. The capsules were originally installed in the reactor prior to its initial startup. Neutron flux and fluence determinations from a vessel wall neutron flux monitor assembly are also presented. (GRA)

2356 (AD/A-004779) EXPERIMENTAL INVESTIGATION OF HEAT RELEASE IN A PARTICLE SEEDED VORTEX. Final Report, 1 November 1972–30 August 1974. Robinson, R. A. (Battelle Columbus Labs., Ohio (USA)). Nov 1974. Contract F33615-73-C-4027. 53p. NTIS $4.25.

The thermo-hydraulic and fluid flow characteristics of a confined two-phase, two-component vortex were investigated both experimentally and analytically. The solid components of the two-phase mixtures that were studied were stainless steel microspheres and naturally enriched uranium dioxide spheroidized particles. The fluid component of the gas-solid vortex was either air or helium gas. An experimental apparatus was designed, fabricated, and operated to provide data on the effects of heat release from suspended particles on the fluid dynamics of a two-phase vortex chamber that simulated a colloid-core nuclear reactor. The apparatus was initially operated in the laboratory to provide baseline nonheated data and subsequently was located in a test cell of the Battelle Research Reactor to provide fission heating in the uranium dioxide particles. (GRA)

2357 (AGC-0570-16(01)FP) NERVA ENGINE EXPLOSIVE DESTRUCT SYSTEM, SUBTASK 1.6. Technical Reference Report for Contract Year 1962. (Aerojet-General Corp., Downey, Calif. (USA)). Aug 1963. Contract SNP-1. 197p. Dep. NTIS $13.00.

Declassified 19 Sep 1975.

The Aerojet Ordnance Research Division is investigating explosive destruct systems to meet both the anticriticality and the postoperation safety criteria. Thirteen destruct system concepts were established and studied during 1962. Three apply directly to anticriticality; seven apply directly to postoperation; and three apply to both systems as possible bifunctional candidates. Additional investigation is being conducted in basic fragmentation and explosive irradiation in support of the difficult technical task imposed by the postoperation destruct criteria. Detailed test results are presented. (auth)

2358 (AGC-0716-16(05)MP) NERVA ENGINE EXPLOSIVE DESTRUCT SYSTEM, SUBTASK 1.6. Monthly Progress Report for February 1963. (Aerojet-General Corp., Downey, Calif. (USA)). Feb 1963. Contract SNP-1. 217p. Dep. NTIS $14.00.

Declassified 18 Sep 1975.

The objective of the program is to satisfy two basic NERVA engine safety requirements: (1) render the reactor essentially harmless in the event of accident or malfunction prior to its use, and (2) dispose of the fission products, generated during operation of the reactor, prior to the engine's re-entry into the earth's atmosphere. The time prior to the reactor's use is termed the "anticriticality" period. Anticriticality extends from launch-pad handling to NERVA engine startup. Safety during this period requires: (1) fracturing the reactor core into subcritical masses, and (2) dispersing these fragments in such a pattern that portions of the core can not combine in geometries capable of becoming critical in a highly moderating substance such as water. The postoperation period extends from engine startup through engine operation and shutdown to its eventual destruction. Destruct during this period requires pulverizing the core into particles less than $\frac{1}{32}$ to $\frac{1}{16}$ in. in diameter so that re-entry ablation will eliminate fission product contamination of the earth's habitable surface. Aerojet is investigating explosive destruct systems to meet both the anticriticality and the postoperation safety criteria. Additional investigation is being conducted in graphite fragmentation, in explosive irradiation, and in mechanical feasibility. The following technical discussion presents the history of work accomplished during January 1963. Detailed test results and design and fabrication details are presented. (auth)

2359 (AGC-0716-16(09)MP) NERVA ENGINE EXPLOSIVE DESTRUCT SYSTEM, SUBTASK 1.6. Monthly Progress Report

for June 1963. (Aerojet-General Corp., Downey, Calif. (USA)). Jun 1963. 91p. Dep. NTIS $7.75.

Declassified 8 Oct 1975.

In anticriticality Destruct System development a series of three slab-target/linear shaped charge tests was conducted. A large-scale test of the Mark C concept gave unsatisfactory results. The latest configuration of the Mark A concept resulted in the successful achievement of the anticriticality destruct criteria. In Postoperation Destruct System development a large scale test of the standard Mark D and Mark J concept configuration with controlled delayed initiation gave good preliminary results, with a total time span of 7.5 msec. In Fragmentation Research an analysis of structural interference effects on fragment dispersal indicates the bifunctional Mark D system is the best concept from this standpoint to date. In the Explosives Irradiation Program a series of capsule sealing tests was conducted. Of the designs tested, a blast-cup seal/lead gasket configuration gave best results. Temperature and pressure calculations were performed to indicate the maximum conditions existing in the irradiation capsule immediately following explosive detonation. The characteristics of passive temperature indicators made of Cerro-alloy wire were calculated to evaluate the material's use under the criteria. In the Mechanical Feasibility Study a series of linear shaped charge tests was conducted to investigate: (1) cutting performance, (2) optimum standoff, and (3) initiation mode. (auth)

2360 (AGC-0716-16(12)MP) NERVA ENGINE EXPLOSIVE DESTRUCT SYSTEM, SUBTASK 1.6. Monthly Progress Report for September 1963. (Aerojet-General Corp., Downey, Calif. (USA)). Sep 1963. Contract SNP-1. 36p. Dep. NTIS $5.00.

Declassified 24 Sep 1975.

A conservative configuration of the Mark A, Mod 2 Anticriticality Destruct System (ACDS) was tested against a full-scale simulated engine on a 50-ft tower. The test failed to defeat the inner barrel of the pressure vessel, and thus did not meet the anticriticality destruct criteria; this emphasized the importance of using adequate cutting or rupturing charges in the Mark A ACDS. Test MC-95 was conducted as a part of underwater tests to improve fragment recovery techniques. A fine-mesh screen covered the top of the underwater tank, but fragment recovery was only negligibly improved (86% of total mass). Tests MC-96 and MC-98 were conducted as a continuation of the post-test fragment analysis series. Plastic deformation, with attendant slight variation in density, was experienced, but the rods affected, as well as the number of plastically deformed fragments, were apparently reduced as compared to previous tests. Extensive fragment analysis of Test MC-96 by zones was not possible because the color-coding paint did not remain on the fragments. Preparations continue for beginning the explosives irradiation experiments. The preliminary design of the ejectable Mark A ACDS and the conceptual design of the Mark D bifunctional destruct system were completed. (auth)

2361 (AGC-2200(Vol.3)) NERVA ENGINE DEVELOPMENT PROGRAM AND ASSOCIATED TASK. Final Report for the Period 10 July 1961–10 January 1962. Volume III. NERVA Engine Support Systems and Functions. (Aerojet-General Corp., Azusa, Calif. (USA)). Feb 1962. Contract SNP-1. 135p. Dep. NTIS $9.75.

Declassified 23 Sep 1975.

Engine-support systems and functions related to the NERVA engine development program but not an integral part of the hardware design, development, fabrication, and testing are discussed. Also covered are the support-equipment system, including the remote-handling, checkout and test, and ground-handling items; the diagnostic-instrumentation system; field support; reliability; safety; and Los Alamos Scientific Laboratory support functions. (auth)

2362 (AGC-2560(Vol.6)(Add.2)) REVISED BUDGET ESTIMATES, 1965 NERVA DEVELOPMENT PROGRAM. Volume VI, Addendum II. Alternate Plan, Reduced FY 1964 Budget. (Aerojet-General Corp., Sacramento, Calif. (USA)). 6 May 1963. 25p. Dep. NTIS $4.25.

Extensive changes in the planned technical program are detailed as a result of a budget cut of approximately 10 million dollars. The least effect on the overall program resulted in a delay of major hardware procurement and fabrication and a modest reduction in reactor development. Scheduling changes were also required. (LTN)

2363 (AGC-2931) NUCLEAR LUNAR LOGISTICS STUDY. (Aerojet-General Corp., Azusa, Calif. (USA)). 18 Jul 1963. 51p. Dep. NTIS $5.75.

Declassified 23 Sep 1975.

All presentation aid material, together with some explanatory text, used during an oral briefing on the Nuclear Lunar Logistics System given at the George C. Marshall Space Flight Center, National Aeronautics and Space Administration, on 18 July 1963 has been documented to present the current general status of the NERVA nuclear rocket development, the characteristics of certain operational NERVA-class engines, and appropriate technical and schedule information. (auth)

2364 (AGC-8207-63-24) NRX-A1 LRP PRE-TEST ANALYSIS CURVES INCLUDING PRESSURE AND TEMPERATURE PREDICTIONS FOR THE MOST SEVERE CONDITIONS EXPECTED FOR THE NRX-A1 TESTS IN NEVADA. Uffer, R. A. (Aerojet-General Corp., Sacramento, Calif. (USA)). 11 Dec 1963. 97p. Dep. NTIS $6.00.

Declassified 24 Sep 1975.

The selection of suitable tests to simulate the actual performance test conditions is considered. With care, the flow tests of the reactor can be simulated satisfactorily by values within a few percent of those expected in the actual test. Only the most adverse reactor conditions will be simulated. Other details are discussed. (LTN)

2365 (AGC-10048) MODEL SPECIFICATION: ENGINE, ROCKET, NUCLEAR, HOT BLEED CYCLE, MODEL NO. AJ30-1. (Aerojet Nuclear Systems Co., Azusa, Calif. (USA)). 18 Oct 1960. 55p. Dep. NTIS $5.75.

Declassified 24 Sep 1975.

This specification covers the requirements for the AJ30-1 Rocket Engine which is a liquid propellant, turbopump-fed nuclear rocket engine rated at 55,000 lb nominal vacuum thrust. The rocket engine consists of a thrust chamber assembly, one turbopump assembly, a gas bleed nozzle assembly, connecting lines and fittings, and components required for engine operation and all supported by a mount structure. The thrust chamber consists of a pressure vessel enclosing a two pass reactor. The propellant utilized is liquid hydrogen. The turbine drive gas is bled off ahead of the main nozzle throat and diluent added for temperature reduction. In addition the rocket engine includes vector control, restart capability, and propellant utilization systems. The turbine will be accelerated during start using gas generated from the heat capacity of the reactor. Tank pressure causes the initial flow of propellant through the engine and this pressure is supplemented by pump pressure rise as the turbopump accelerates. (auth)

2366 (AGC-10095A) PRELIMINARY MODEL SPECIFICATION: ENGINE, ROCKET, NUCLEAR, SHIELDED MODEL NO. AJ30-5 (HOT-BLEED). (Aerojet-General Corp., Sacramento, Calif. (USA)). 19 Oct 1961. 56p. Dep. NTIS $6.00.

Declassified 23 Sep 1975.

This specification covers the requirements for the AJ30-5 Shielded Nuclear Rockets Engine, which is a liquid propellant, turbopump-fed nuclear engine rated at 56,590 lb nominal vacuum thrust. The engine consists of a thrust chamber assembly, a turbopump assembly, connecting lines and fittings, and components required for engine operation, all supported by a mount structure. The thrust chamber consists of a pressure vessel enclosing a beryllium reflected graphite core reactor with a primary shield, a nozzle assembly, and a gimbal mechanism. The propellant utilized is liquid hydrogen. The turbine drive gas will be bled off ahead of the main nozzle throat and diluent added for temperature reduction. In addition the engine includes vector control and restart capability systems. The turbine will be accelerated during start using gas generated from the heat capacity of the reactor core, shield, reflector, and nozzle. Tank pressure causes the initial flow of propellant through the engine and this pressure is supplemented by pump pressure rise. (auth)

2367 (AGC-10095C) PRELIMINARY MODEL SPECIFICATION: ENGINE, ROCKET, NUCLEAR, SHIELDED, HOT-BLEED, MODEL NO. AJ30-5. (Aerojet-General Corp., Sacramento, Calif. (USA)). 10 Feb 1962. 89p. Dep. NTIS $7.50.

Declassified 22 Sep 1975.

This specification establishes the requirements for the AJ30-5 Shielded Nuclear Rocket Engine (FX Series) with hot-bleed turbopump drive gas. The FX engines are those built for use in the RIFT flight test. The AJ30-5 Shielded Nuclear Rocket Engine is a liquid propellant, turbopump-fed nuclear engine designed to operate at a nominal vacuum thrust level of 55,600 pounds. (auth)

2368 (AGC-10095D) PRELIMINARY MODEL SPECIFICATION: ENGINE, ROCKET, NUCLEAR, SHIELDED, HOT-BLEED, MODEL NO. AJ30-5. (Aerojet-General Corp., Sacramento, Calif. (USA)). 1 Nov 1962. 109p. Dep. NTIS $8.50.

Declassified 23 Sep 1975.

This specification establishes the requirements for the AJ30-5 Shielded Nuclear Rocket Engine (FX Series) with hot-bleed turbopump drive gas. The FX engines are those built for use in the RIFT flight test. The AJ30-5 Shielded Nuclear Rocket Engine is a liquid propellant, turbopump-fed nuclear engine designed to operate at a nominal vacuum thrust level of 56,350 pounds. (auth)

2369 (AGC-10097) PRELIMINARY MODEL SPECIFICATION. Engine, Rocket, Nuclear, Shielded, Model No. AJ31-6 (Heated Bleed). (Aerojet-General Corp., Azusa, Calif. (USA)). 23 Mar 1961. 36p. Dep. NTIS $5.00.

Declassified 23 Sep 1975.

This specification covers the requirements for the AJ31-6 Nuclear Rocket Engine, which is a liquid propellant, turbopump-fed nuclear engine rated at 56,780 lb nominal vacuum thrust. The engine consists of a thrust chamber assembly, a turbopump assembly, connecting lines and fittings and components required for engine operation all supported by a mount structure. The thrust chamber consists of a pressure vessel enclosing a beryllium reflected graphite core reactor with a primary shield, a nozzle assembly and a gimbal mechanism. The propellant utilized is liquid hydrogen. The turbine drive gas will be obtained from the upper reactor pelnum and heated in the nozzle skirt. In addition the engine includes vector control and restart capability systems. The turbine will be accelerated during start using gas generated from the heat capacity of the nozzle, reflector and shield. Tank pressure causes the initial flow of propellant through the engine and this pressure is supplemented by pump pressure rise as the turbopump accelerates. (auth)

2370 (ER-7802) SUPPORT EQUIPMENT SYSTEMS PLAN: NERVA REMOTE HANDLING EQUIPMENT. (Aerojet-General Corp., Sacramento, Calif. (USA)). 2 Jan 1963. 192p. Dep. NTIS $8.50.

Declassified 18 Sep 1975.

In most instances, there are several approaches to the accomplishment of a remote handling task. At one extreme, a remote handling system consisting of very simple equipment will perform the task for the least capital equipment expenditure but may require an inordinately long operating time; whereas, at the other extreme, a special automated machine will perform the same task in the least time but will probably be very expensive. Four different types of remote handling equipment were investigated for Project NERVA: the conveyor system, the travelling manipulator concept, the multipurpose stand system, and the mobile stand system. These four concepts were evaluated on the basis of reliability, flexibility and adaptability, ease of operation, turnaround time, cost, maintenance, and various miscellaneous factors. The recommended system involves a combination of three subsystems embodying the best features of the methods evaluated. (auth)

2371 (L-0560-10-5) AEC-NASA NUCLEAR PROPULSION OFFICE INFORMAL MONTHLY PROGRESS LETTER NO. 5, 1 1 NOVEMBER–30 NOVEMBER 1961. Project NERVA. (Aerojet-General Corp., Azusa, Calif. (USA)). 1961. 68p. Dep. NTIS $5.50.

Declassified 23 Sep 1975.

Continuing effort was devoted to the program planning associated with the definition of the complete engine development and associated tests. The design, development and testing of components progressed satisfactorily. (auth)

2372 (L-0560-10-6) INFORMAL MONTHLY PROGRESS LETTER NO. 6 TO AEC-NASA SPACE NUCLEAR PROPULSION OFFICE FOR PROJECT NERVA. Covering Period: 1 December–31 December 1961. (Aerojet-General Corp., Azusa, Calif. (USA)). 1961. 55p. Dep. NTIS $5.50.

Declassified 23 Sep 1975.

Technical and management effort has continued toward the accomplishment of overall program milestones and objectives. With very few exceptions, all program milestones will have been achieved before the conclusion of the present program on 10 January 1962. These exceptions, primarily associated with certain component test programs, are discussed under the appropriate heading and listed in the program status summary. Continuing discussions have been held with program participants and with NASA, AEC, and SNPO personnel in conjunction with specific areas of interest and activities. The more significant of these discussions are discussed under appropriate task item headings. (auth)

2373 (L-0560-10-11) INFORMAL MONTHLY PROGRESS LETTER NO. 11 TO AEC-NASA SPACE NUCLEAR PROPULSION OFFICE FOR PROJECT NERVA. Covering Period: May 1962. (Aerojet-General Corp., Sacramento, Calif. (USA)). 1962. 87p. Dep. NTIS $6.00.

Declassified 30 Sep 1975.

Progress in reactor design and in component design and testing is reported. Progress in the design, fabrication and testing of a reactor simulator is discussed. Test facilities, ground support and remote handling equipment, diagnostic instrumentation, reliability, quality control, health and safety, etc. are treated briefly. (LTN)

2374 (L-0560-10-23) INFORMAL MONTHLY PROGRESS LETTER NO. 23 TO AEC-NASA SPACE NUCLEAR PROPULSION OFFICE COVERING THE PERIOD OF MAY 1963. (Aerojet-General Corp., Azusa, Calif. (USA)). May 1963. 242p. Dep. NTIS $9.00.

Declassified 24 Sep 1975.

Progress on the design and development of NRX-A1 and NRX-A2 reactors is reported, especially with respect to turbopumps, fuel elements, nozzles and actuators. Progress in the development of reactor simulators and mathematical models is summarized. Test facilities preparations are discussed briefly. (LTN)

2375 (L-0560-10-27) INFORMAL MONTHLY PROGRESS LETTER NO. 27 TO AEC-NASA SPACE NUCLEAR PROPULSION OFFICE FOR NERVA PROGRAM. Covering Period of September 1963. (Aerojet-General Corp., Azusa, Calif (USA)). Oct 1963. 251p. Dep. NTIS $10.00.

Declassified 24 Sep 1975.

The major emphasis was directed toward the establishment of the Program Plan for Contract Year 1964. The test plan for NRX-A1 has been formulated, submitted, and approved by SNPO-C. The Phase I Vibration Test Reactor has been subjected to vibration test runs at ½ g and 1 g inputs at frequencies of 200, 100, 50, 30, 20, 15, and 10 cps. The data from these tests are being analyzed to determine the scope of subsequent test and data requirements for proving reactor integrity with respect to vibration. Recent runs in the fuel-element coating furnaces indicate that refinement in operating techniques are yielding more adherent coatings of acceptable thickness. The TPA bearing completed oae hour of successful operation under rated conditions. Efforts are continuing to resolve the problem of nozzle fabrication. Tests have established the range of explosive weight required to effect proper anti-criticality destruction and break-up of the core. Construction has been completed on Test Stand ETS-1. (auth)

2376 (N-72-27723) GAS-CORE REACTOR POWER TRANSIENT ANALYSIS. Final Report. Kascak, A. F. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). 1972. 18p. (NASA-TM-X-68089; E-7000). NTIS $3.00.

From American Nuclear Society meeting; Las Vegas, NV (18 Jun 1972).

The gas core reactor is a proposed device which features high temperatures. It has applications in high specific impulse space missions, and possibly in low thermal pollution MHD power plants. The nuclear fuel is a ball of uranium plasma radiating thermal photons as opposed to gamma rays. This thermal energy is picked up before it reaches the solid cavity liner by an inflowing seeded propellant stream and convected out through a rocket nozzle. A wall-burnout condition will exist if there is not enough flow of propellant to convect the energy back into the cavity. A reactor must therefore operate with a certain amount of excess propellant flow. Due to the thermal inertia of the flowing propellant, the reactor can undergo power transients in excess of the steady-state wall burnout power for short periods of time. The objective of the study was to determine how long the wall burnout power could be exceeded without burning out the cavity liner. The model used in the heat-transfer calculation was one-dimensional, and thermal radiation was assumed to be a diffusion process. (auth)

2377 (NDC-12B) NERVA DESIGN CRITERIA. Nozzle Assembly, Propellant-Cooled, for Heated-Bleed Engine AJ31-6. (Aerojet-General Corp., Azusa, Calif. (USA)). 1 Feb 1962. 17p. Dep. NTIS $4.00.

These design criteria establish the requirements for the propellant-cooled nozzle assembly, consisting of nozzle and nozzle extension, used on the AJ31-6 Heated-Bleed Nuclear Rocket Engine. (auth)

2378 (NP-20549) ANNUAL REPORT, 1974. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1974. 99p. (In German). Dep. NTIS (US Sales Only) $8.00.

The research and development work done in the areas of nuclear ship design, materials technology for light water reactors, water desalinization, and environmental studies are reviewed and the most significant results are indicated. Cooperative endeavors with industry, research centers, and schools are reported. The publications, reports, and lectures by the staff members are tabulated. (JSR)

2379 (NTO-R-0008) NRX-A2 SITE TEST REPORT. (NERVA Test Operations, Mercury, Nev. (USA)). 20 Nov 1964. 235p. Dep. NTIS $9.00.

Declassified 18 Sep 1975.

The NRX-A2 Test Series was performed at NRDS. This series, which incorporated a total of six experimental plans, successfully demonstrated the ability of the Test Assembly to operate at steady state conditions up to design point power and provided valuable experimental data applicable to the design of future NRX reactors.

No apparent damage to the Test Assembly was observed under the test conditions. All experimental plans were successfully performed as planned or as approved by the Test Review Board and all test objectives were satisfied. (auth)

2380 (NTO-R-0037) NRX-A3 POST TEST REPORT. (NERVA Test Operations, Jackass Flats, Nev. (USA)). [nd]. 210p. Dep. NTIS $8.75.

Declassified 18 Sep 1975.

The NRX-A3 Disassembly operation was performed at the R-MAD Facility at NRDS. At the present time, routine hot cell operations have been completed; replication and fuel fatigue studies are in the final stages of completion. The results noted during the post-test operations have confirmed the ability of the NRX-A3 Test Assembly to operate at conditions of design point power for a pre-determined time and have provided valuable data applicable to the design of future NRX Reactors. No damage related to full power testing was apparent in the non-nuclear hardware, the core support assembly, the outer reflector assembly, and cluster hardware, except for support blocks where considerable corrosion had occurred in the tie rod holes. The fuel region components sustained minor damage. Some fuel elements within a cluster were fused together and, in some instances, fuel element clusters were fused together. Interstitial surface corrosion, pinholing, channel exposure and corrosion at the nozzle undercut area were the major types of surface effects noted on the fuel elements. The surface coated elements and the unfueled tips at the nozzle end of fuel elements were generally in good condition. The test car and related systems experienced no damage. To date, essentially all post-test inspections have been successfully performed as planned or approved by the Test Specification and Procedure Review Board and all post-test objectives are being satisfied. (auth)

2381 (NTO-R-0061) TEST REPORT: STEAM GENERATOR DEVELOPMENT TEST PROGRAM. Keasling, T. A. (NERVA Test Operations, Jackass Flats, Nev. (USA)). Mar 1966. 75p. Dep. NTIS $5.50.

The ETS-1 Steam Generator System was set up for single module, full-steam operation, and the Development Test Program Experimental Plan IV was conducted. A total of five 60-seconds-duration, full-steam tests were performed using fuel conditioned to temperatures between about 40°F to 68°F; in addition, two water flow, two fuel flow, and two short-duration adjustment tests were made during the EP-IV activities. The combustion chamber injection water system was modified to minimize the piping pressure losses and to improve flow control. The modified system operated successfully and steam exhaust temperatures up to 950°F were established on the longer full-steam tests. During the test series no significant change in the injector condition occurred. The combustion chamber initially used developed two cracks in the upper expansion joint on the fourth 60-seconds-duration run, and was replaced for the last full-steam test. Upon completion of the test series, activities began for the rework, modification, and assembly of the steam generator modules and system, as appropriate, in preparation for the succeeding phase of the Development Test Program. (auth)

2382 (NTO-R-0097(Suppl.1)) NRX-A5 POST-TEST REPORT. Supplement. (Aerojet-General Corp., Jackass Flats, Nev. (USA)). [nd]. 86p. Dep. NTIS $7.50.

Declassified 24 Sep 1975.

As part of the continuing post-operational examination of the NRX-A5 reactor components, a group of whole NERVA fuel elements, sectional fuel metallographic samples and selected items of cluster hardware were shipped in shielded casks to the Los Alamos Scientific Laboratory for further examination in the CMB-14 hot cells. A brief description of the work performed at LASL is given, including some observations on the general condition of the components examined. Also included is a report on additional studies performed at NRDS on the NRX-A5 nozzle. (auth)

2383 (RN-0560-10-29) AEC-NASA SPACE NUCLEAR PROPULSION OFFICE NERVA PROGRAM. Informal Monthly Progress Report Letter No. 29, November 1963. (Aerojet-General Corp., Azusa, Calif. (USA)). 1963. 212p. Dep. NTIS $8.75.

Declassified 29 Sep 1975.

The NRX-A1 reactor and simulated shield was shipped by rail from Large, Pa., arrived at Las Vegas on November 18, and the next day at Jackass Flats. Receiving inspection began immediately and by November 22 the reactor was positioned in the rotating fixture in the R-MAD building. The overall assembly of Test Car T-2 was brought to near completion. An aluminum pressure vessel was delivered to the NRX-A1 engine buildup assembly. Fabrication of the aluminum pressure vessel, scheduled for NRX-A3, was completed and passed vendor hydrotest. It is now awaiting disposition on manufacturing discrepancies. NRX-A nozzle fabrication and testing results are summarized. (auth)

2384 (RN-64005) GASEOUS CORE REACTOR ANALYSIS. A Proposal to Lewis Research Laboratory. (Aerojet-General Corp., Azusa, Calif. (USA)). 10 Apr 1964. 16p. Dep. NTIS $4.50.

Declassified 18 Sep 1975.

Comparisons of diffusion theory and transport theory to critical experiments and to each other, using 1- and 2-dimensional analyses and various S_n approximations, show a few trends and permit a few conclusions. The critical mass of a cavity reactor critical experiment is predicted within 15% and 24% by diffusion and transport theory respectively when 2-dimensional theory is used. The shape factor converting cylindrical geometry to spherical geometry with equal reactivity is shown to be very important when using transport theory in predicting cylindrical reactors with spherical theory. The choice of S_n approximation is shown to be relatively unimportant for the distributed fuel cavity core critical, and presumably, therefore, for the gaseous core reactors of interest. One-dimensional diffusion theory usually predicts a larger critical mass than does one-dimensional transport theory, although one case presented shows the opposite relationship. The comparison of results of 2-dimensional diffusional theory to results of 2-dimensional transport theory for the same model shows closer agreement than the comparison of 1-dimensional calculations. These trends and conclusions are somewhat tentative, being based on a limited number of calculations. They provide some insight into the problem of choice between diffusion and transport theory. (auth)

2385 (RN-64005A(Fol. 3)) GASEOUS CORE REACTOR ANALYSIS. A Proposal to Lewis Research Laboratory. (Aerojet-General Corp., Azusa, Calif. (USA)). 25 May 1964. 16p. Dep. NTIS $4.50.

Declassified 18 Sep 1975.

The comparisons of diffusion theory and transport theory to critical experiments and to each other, using 1- and 2-dimensional analyses and various S_n approximations, show a few trends and permit a few conclusions. The critical mass of a cavity reactor critical experiment is predicted within 15% and 24% by diffusion and transport theory respectively when 2-dimensional theory is used. The shape factor converting cylindrical geometry to spherical geometry with equal reactivity is shown to be very important when using transport theory in predicting cylindrical reactors with spherical theory. However, the shape factor is relatively unimportant when using diffusion theory. The choice of S_n approximation is shown to be relatively unimportant for the distributed fuel cavity core critical, and presumably, therefore, for the gaseous core reactors of interest. One-dimensional diffusion theory usually predicts a larger critical mass than does one-dimensional transport theory, although one case presented shows the opposite relationship. The comparison of results of 2-dimensional diffusional theory to results of 2-dimensional transport theory for the same model shows closer agreement than the comparison of 1-dimensional calculations. These trends and conclusions are somewhat tentative, being based on a limited number of calculations. They provide some insight into the differences between diffusion and transport theory. (auth)

2386 (RN-64013) NERVA NOZZLE PROGRAM PLAN CY 1965 AND 1966. Period Covered: 1 January 1965–30 September 1966. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1964. 81p. Dep. NTIS $6.00.

Declassified 18 Sep 1975.

A twenty-one month, incentive-fee plan, nozzle development program is presented in response to the request received from SNPO-C on 19 November 1964. The objective of the nozzle program is to develop a regeneratively cooled nozzle containing a hot bleed port through which turbine gas is withdrawn. The nozzle must be capable of operating satisfactorily in the nuclear environment anticipated for NERVA and, by means of chemical simulation firings using LH_2/LO_2 as propellants, of demonstrating the capability of operating for ten minutes at the expected maximum heat flux or gas well temperatures anticipated for the nuclear case. Objectives are to develop a nozzle capable of operating satisfactorily in the nuclear environment for expected XE engine duration and to fabricate sufficient nozzles to support the NRX and XE programs, including simulation testing. (auth)

2387 (RN-66251) SNRE SMALL NUCLEAR ROCKET ENGINE FOR UNMANNED SPACE PROBE MISSIONS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1966. 85p. Dep. NTIS $6.00.

Declassified 7 Oct 1975.

A design for a Topping Cycle–Small Nuclear Rocket Engine

(SNRE) of 10,000 lb thrust is presented based on a zirconium hydride-moderated, 200 MW reactor design concept and present technology for non-nuclear engine components. Emphasis is given to the engine description, performance and operation, to the turbopump and to the nozzle design features. An alternate, hot bleed cycle SNRE, design with additional turbopump and nozzle development is discussed briefly. A potential development program covering a period of five years from start to initial operational capability is suggested with reference to engine system tests, turbopump and nozzle schedules and an indication of possible schedules for stage ground and flight tests. It is intended that this report provide the basis of support to NASA (MSFC), or to a stage contractor, in the conduct of the Mission Analysis Program contemplated by MSFC to investigate requirements and capabilities of nuclear powered stages for unmanned deep space probes. Performance and operational data are attached. (auth)

2388 (RN-A-0001(Vol.1)) NERVA SUMMARY REPORT FOR CONTRACT YEAR 1963. (Aerojet-General Corp., Azusa, Calif. (USA)). Dec 1963. Contract SNP-1. 135p. Dep. NTIS $9.75.

Declassified 22 Sep 1975.

In September 1962, two decisions were made which materially affected the Contract Year 1963 technical program. The first was the decision to proceed with the hot-bleed engine cycle alone, instead of investigating both the hot-bleed and heated-bleed cycles. The second decision was to eliminate any plans for the use of a thermal-barrier coating on the nozzle. As a result of these decisions, a redesign of the turbopump assembly (TPA) was started to accommodate the required additional head rise, and the nozzle design was reoriented from the heated-bleed to the hot-bleed cycle. The TPA development required extensive testing of the MARK III, Mod 2 TPA. The additional head rise was achieved and this unit is considered to have the capability of meeting the FX engine requirements. One of the major problems was the development of a liquid-hydrogen-cooled bearing. In the latter part of the year a CFDTS utilizing a MARK IV TPA became a requirement. These decisions resulted in postponing the obtaining of experimental data on the reactor boot-strap start up. As a result of a Kiwi reactor problem that became apparent in November 1962, the overall engine system work was de-emphasized and the emphasis shifted to give more importance to pre- and post-test analyses of the reactor. Based upon direction of SNPO, REON instructed WANL to change the reactor design to provide improved lateral support of the fuel elements. Nozzle development continued. Other objectives, problems and accomplishments are summarized. (auth)

2389 (RN-A-0001(Vol.2)) NERVA SUMMARY REPORT FOR CONTRACT YEAR 1963. (Aerojet-General Corp., Azusa, Calif. (USA)). Dec 1963. Contract SNP-1. 419p. Dep. NTIS $24.00.

Declassified 22 Sep 1975.

Contracted engineering work is reported related to NERVA components: Engine systems, thrust chamber assembly, engine controls, pneumatic system, reactor instrumentation, destruct systems and effects of radiation on reactor materials. (LTN)

2390 (RN-A-0003(Vol.1)) NERVA SUMMARY REPORT FOR CONTRACT YEAR 1964. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1964. Contract SNP-1. 88p. Dep. NTIS $7.50.

Declassified 19 Sep 1975.

The most important accomplishments were the NRX-A1 and NRX-A2 tests of the capability of the reactor design concept to withstand, under both cold flow and full power hot firing conditions, the thermal, pressure and nuclear environment inherent to the system. In addition to the confidence in the reactor capability generated by these tests, they also showed that the stainless steel U-tube nozzle design was qualified for use on NRX tests and for development of the hot bleed port configuration. Design, procurement, hardware fabrication and delivery were on schedule to support initial engine bootstrap investigations with the Cold Flow Development Test System (CFDTS) commencing in March 1965. Conceptual design and program planning had been completed for an early Engine System Test (NRX/EST) with an upward firing system in Test Cell "A" to demonstrate bootstrap-to-power and transient behavior of a close-coupled engine system. NRX/EST tests are scheduled to be conducted early in the fall of 1965. Design of an Experimental Engine (XE) to demonstrate system feasibility in tests at ETS-1 was initiated in place of the previously planned, flight oriented, E-engine. Other specific, significant accomplishments in areas other than system design and operation are described; in particular, extensive test results of turbopump performance and characteristics are given. (auth)

2391 (RN-DR-0012) NRX A-1 ENGINE THERMAL MODEL. (Aerojet-General Corp., Azusa, Calif. (USA)). Apr 1964. 35p. Dep. NTIS $5.00.

Declassified 26 Sep 1975.

NERVA Engine Information currently used on transient digital computer program No. 364 is presented, taken directly from drawings, reports, and approximations from drawings. Approximations are made by substituting common geometric configurations for complicated shapes and contours. The selection of the data is governed by the needs of the digital program, but it is also applicable to the Basic Engine Analog Computer Model. The information serves as a source of dimensional information in a concise tabulated form and presents a detailed development of the digital model based on current conceptions as to how the engine should be represented. (auth)

2392 (RN-DR-0072) NRX/EXT TEST PREDICTIONS REVIEW MEETING. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1965. 311p. Dep. NTIS $10.75.

Declassified 19 Sep 1975.

2393 (RN-DR-0079(Vol.2)) NERVA ENGINE DEVELOPMENT PROGRAM PLAN. Volume II. Technical Discussion. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1966. 294p. Dep. NTIS $10.25.

Declassified 18 Sep 1975.

The NERVA engine is to be a hot-bleed cycle, turbopump-fed engine utilizing a nuclear reactor as a heat source and hydrogen as the reactor coolant and engine propellant. The engine features a single-stage, centrifugal turbopump with a low-speed inducer delivering 246 lb/sec of hydrogen at a head of 1086 psi with a nominal NPSP of 2.5 psi at the tank outlet. The turbine is driven by 15.2 lb/sec of 1660°R hydrogen gas bled from the reactor inlet plenum and nozzle chamber. The reactor is graphite-moderated operating at 4180 MW and supplying 4500°R hydrogen gas to the nozzle. The nozzle is a regeneratively cooled U-tube, convergent-divergent nozzle with two hot-bleed ports. The nozzle area ratio is 4:1 and the chamber pressure is 517 psia. The skirt extends from an area ratio of 4:1 to 40:1 and is regeneratively-cooled by cryogenic hydrogen. Overall engine I_{sp} is 800 seconds: overall thrust is 200,000 pounds. The engine is designed to enable remote installation and removal from the ETS-1 and ESTS 2/3 test facilities employing the engine installation vehicle. (auth)

2394 (RN-DR-0103(Vol.2)) NUCLEAR ROCKET OPERATIONS: NUCLEAR PRODUCTS AND SERVICES GROUP. Volume II. Technical Discussion. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1967. 358p. Dep. NTIS $11.50.

Declassified 7 Oct 1975.

Technical information is provided to support the program plan and the cost estimates. Technical objectives, descriptions of systems and components comprising the NERVA engine are given, and problem areas and potential solutions or approach to be pursued in resolution are discussed. The engine configurations employed in the development program are all minor variations of the same basic engine design using a hot bleed cycle with a turbopump providing hydrogen at proper pressure and flow rate and utilizing a nuclear reactor as a heat source with hydrogen (serving as reactor coolant and engine propellant) expelled through a RAO-contoured nozzle. The engine thrust level is 200,000 pounds and the reactor power is 4200 Mw. The thrust and reactor power levels were selected after an extensive parametric study over the thrust range of 190,000 to 250,000 pounds involving both engine and stage mission studies. (auth)

2395 (RN-PA-0004) MATERIALS FOR NUCLEAR ROCKET NOZZLES. Funk, C. W.; Weleff, W. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1965. 18p. Dep. NTIS $4.50.

Declassified 19 Sep 1975.

The design of nozzles for future nuclear rocket engines requires consideration of extended firing duration, higher levels of nuclear radiation and thermal heating of materials, increased chamber pressure, and heat flux in the regeneratively cooled nozzle. The new design concept provides advantages of a positive sealing envelope, direct removal of gamma produced heat from jacket and structural stability of a shear type braze joint, which can be stressed to loads directly proportional to the selected depth of the braze groove. The selection of materials for the nozzle is based on a detailed examination of materials properties to meet specific design and environmental conditions. The analysis concludes that the material for the coolant channels requires a solution-hardened, nickel-base alloy for service temperature above 1500°F to exhibit the best fabrication reliability and the most stable structural properties in service. The jacket material must closely match the differential thermal expansion of the coolant channel to assure reliability of fabrication and service. (auth)

2396 (RN-PA-0007) REVIEW OF NERVA COUNTERMEASURE SYSTEMS AND CONCEPTS. Stinnett, W. D.; Coffman, B. F.; Flagg, A. H. (Aerojet-General Corp., Sacramento, Calif. (USA)). 7 Jun 1966. 42p. Dep. NTIS $5.25.

Declassified 19 Sep 75.

Various means of AntiCriticality Destruct Systems (ACDS) and Post Operational Destruct Systems (PODS) are evaluated in a presentation to the Flight Safety Committee with respect to hazards to populated areas, effectiveness, weight penalty, alternative approaches, etc. The authors recommend that the assumptions used in their evaluation be examined more carefully, as a means of accepting or rejecting their conclusions. (LTN)

2397 (RN-S-0035) NUCLEAR ROCKET ENGINE CYCLE SELECTION. (Aerojet-General Corp., Azusa, Calif. (USA)). Dec 1963. 23p. Dep. NTIS $4.50.

Declassified 17 Sep 1975.

The conversion of a solid-core, heat-exchanger type of nuclear reactor into a thrust-producing rocket engine depends principally on the provision of a system to supply the reactor with coolant or working fluid and a nozzle for extracting the energy from the heated fluid. Aside from the reactor, the major subsystem in the nuclear rocket engine is the propellant feed system. The design of the propellant-feed system and the integration of this system with the reactor to form the nuclear rocket engine is a major and critical engineering task since this system determines the performance of the engine, overall engine configuration, major subsystem configurations, and many individual component specifications. In addition, the type of propellant-feed system employed determines the reliability and the cost and time required for development. The fundamental task to be accomplished is to determine the manner in which the energy required to move the propellant from the tank to the reactor is provided—whether from an external source or from the reactor itself—and, if from the reactor, in what manner the reactor supplies this energy. Extensive engineering design and analysis have shown that there are several approaches which fall into two basic classes: Direct tank pressurization and pumped cycles. All are feasible, all can be developed, and each has advantages and disadvantages. The hot-bleed or the heated-bleed cycles are recommended for the smaller, initial engines and the topping cycle for the larger engines is considered. (auth)

2398 (RN-S-0051) REON RADIATION-EFFECTS PROGRAM REVIEW. (Aerojet-General Corp., Azusa, Calif. (USA)). Jul 1964. 435p. Dep. NTIS $12.75.

Declassified 17 Sep 1975.

The Radiation-Effects Program at REON is primarily a management/service group that provides the necessary scheduling and coordination of Radiation-Effects tests. It is their responsibility to see that all radiation-test activities are well conceived and designed; that experimental data are sound and meaningful; and that useful auxiliary data are taken (where appropriate) in connection with radiation effects tests. The requirements for a test are determined by the component designer, who, in conjunction with the test designer, prepares a test plan describing the objectives, the test conditions, and the parameters to be investigated; and also schedules the dates when the component and test fixture will be available for testing. After evaluation and approval of the test plan, REON schedules and coordinates the test with SNPO and the test facility. In addition, nuclear analyses concerning neutron and gamma fluxes, activation, nuclear heating, and test design are performed by REON for inclusion in test specifications, test procedures, and an evaluation of the proposed test. The test designer is responsible for preparing test specifications and test procedures; designing and fabricating test fixtures; procuring necessary instrumentation and test components; assembling and performing pre-irradiation checkout tests; and packaging and shipping test units to the reactor facility. A final test report which includes pre-, post-, and irradiation test information is prepared by the component and test designers, and distributed to SNPO-C, SNPO-W, REON, WANL, and other NERVA test design groups. The information obtained from the test is integrated into the Radiation-Effects Data Book and into latter phases of the component development program. (auth)

2399 (RN-S-0129) SHIELDING WEIGHT PENALTY AS A FUNCTION OF CLUSTERED NERVA SYSTEMS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jul 1965. 39p. Dep. NTIS $5.00.

Declassified 22 Sep 1975.

The results of a study on engine weight penalty involved in the clustering of separate nuclear rocket systems are summarized. Clusters of from two to seven separate systems were considered, with nominal energy-per-system of 2000, 3300, and 5000 MW. Arbitrary criteria were chosen such that, for a single tank-engine assembly, the maximum allowable energy deposition would be derived from the assembly's own reactor and top shield. Additional radiation supplied from any adjacent system in a cluster would exceed the maximum and, therefore, require additional top and side shielding to maintain allowable limits. The results seem to be comparable to machine calculations conducted by the Lockheed Missile and Space Company and reported herein. In general, clustering increases system weight by 20% of total engine weights clustered. This figure decreases with increasing clustered numbers and power levels. (auth)

2400 (RN-S-0136) ADVANCED PROGRAMS INTEGRATION PRESENTATION. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1964. Contract SNP-1. 15p. Dep. NTIS $4.00.

Declassified 22 Sep 1975.

Material presented at an advanced programs integration presentation has been documented. It includes engine clustering studies, advanced engine studies, nozzle analysis, planned schedules, and research programs in these areas. (LTN)

2401 (RN-S-0266) ADVANCED ENGINE ANALYSIS. Large Diameter NERVA Clustering. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1966. Contract SNP-1. 195p. Dep. NTIS $12.75.

Declassified 22 Sep 1975.

The results of studies conducted by REON and WANL to determine the feasibility and potential problem areas associated with modular nuclear-rocket propulsion units are summarized. The data are concerned primarily with the design and technology implications of the single propulsion module when clustered to attain the large energy requirements for manned planetary exploration. (auth)

2402 (RN-S-0292(Vol. 2)) MINUTES OF FIRST INSTRUMENTATION REVIEW MEETING, MARCH 28–29, 1966. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1966. 188p. Dep. NTIS $8.50.

Declassified 10 Sep 1975.

The performance of reactor instrumentation in NRX-$A2_1$-A3 and-A4-EST is reviewed, including performance, difficulties encountered with particular instruments, radiation effects, and research programs. (LTN)

2403 (RN-S-0317) DATA ANALYSIS REPORT OF NRX-A5 TESTS. Altseimer, J. H.; Benenson, H.; Conn, K. R.: Fong, L. Y.; Kasahara, M.; Naretto, C. J.; Sebek, E. J.; Williams, R. J. (Aerojet-General Corp., Sacramento, Calif. (USA)). 1966. 135p. Dep. NTIS $7.00.

Declassified 11 Nov 1975.

The objectives of the NRX-A5 test series were: Operation at design conditions for an accumulated time of 40 minutes, operation with a "no-flux" temperature controller, and a start with fixed drum positions. The tests were terminated because of an excessive loss of reactivity after an accumulation of only 31.0 minutes of operation with a nozzle chamber temperature above 3600°R and 11.4 minute with the temperature at or above the design valuc of 4090°R. The other two objectives were satisfactorily achieved. Data and the results of analyses and evaluations are presented of the thermal and fluid-flow performance of the NRX-A5 system, the fixed drum start, and other subjects considered of importance in developing a more complete understanding of the Nuclear Reactor Experimental Systems and improving the computer simulations for future systems. (auth)

2404 (RN-S-0435) NE AND NR SYSTEMS ANALYSIS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Nov 1967. Contract SNP-1. 188p. Dep. NTIS $12.50.

Declassified 19 Sep 1975.

Systems analyses carried out in support of the NERVA engine program are described. Parametric studies were made for 15 different concepts of the NERVA engine, ranging in power from 2900 to 5000 MW. Based on these studies, reactor studies by Westinghouse and mission studies by STL, an engine of 200,000-lb-thrust and 4200 MW was selected. Engine components, flight safety, availability of engine and components, test-facility requirements and limitations, and other special subjects were studied in support of the NERVA program. (auth)

2405 (RN-TM-0576) NUCLEAR ROCKET ENGINE PERFORMANCE PROJECTION. Soppet, C. K. (Aerojet-General Corp., Sacramento, Calif. (USA)). 2 Dec 1968. 30p. Dep. NTIS $5.00.

Declassified 8 Oct 1975.

The most powerful means of increasing the specific impulse of a solid core, nuclear rocket engine is to operate at an increased chamber temperature. Other increases may be achieved by use of the topping cycle, minimizing the temperature difference between the hottest spot in the core and the average core exit gas temperature, and by optimizing chamber pressure and nozzle exit area ratio. It will be noted that this last optimization is strongly influenced by mission requirements since the relative value of specific impulse and engine weight are mission affected. There

appears to be good reason to anticipate that solid core nuclear rocket engines can achieve specific impulses in excess of 1,000 before 1995. The dominant means of reducing engine specific weight is to increase reactor power density. Other weight savings can result from optimization of operating parameters for a specific mission and from the normally anticipated improvement in technology as a function of time. The ability of the solid core nuclear rocket engine to outperform competitive systems will be decisively influenced by shielding requirements. However, shielding requirements vary widely for different missions and the optimum solution of the shielding problem is probably not to put all the shielding mass in the engine assembly. Therefore, this study has not included any consideration of shielding weights. (auth)

2406 (TID/SNA-1823) FINAL REPORT OF SHIELD SYSTEM TRADE STUDY. Volume II. WANL Support Activities for Shielding Trade Study. (Aerojet Nuclear Systems Co., Azusa, Calif. (USA); Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1970. 578p. Dep. NTIS $14.75.

Declassified 19 Sep 1975.

Based on the trades made within this study BATH (mixture of B_4C, aluminum and $TiH_{1.8}$) was selected as the internal shield material. Borated titanium hydride can also meet the criteria with a competitive weight but was rejected because of schedular constraints. A baseline internal shield design was accomplished. This design resulted in a single internal shield weighing about 3300 lb for both manned and unmanned missions. WANL checks on ANSC calculations are generally in agreement, but with some difference in the prediction of the effectiveness of the Boral liner. All of the alternate NSS concepts in the system weight reduction program were rejected. While some did save shield weight, they complicated the NSS design to an unacceptable degree. Studies were made of the feasibility of manual maintenance of NSS components outside of the pressure vessel. The requirements of the NSS components located forward of the internal shield were considered from a thermal and radiation damage standpoint. (auth)

2407 (TID/SNA-1835) PHOEBUS-2 THERMAL AND FLUID FLOW ANALYSIS. Hedstrom, J. C. (Aerojet-General Corp., Sacramento, Calif. (USA)). 18 Feb 1965. 44p. Dep. NTIS $5.25.

Declassified 29 Sep 1975.

2408 (TID/SNA-2257) NERVA E-1 EQUATIONS. (Aerojet-General Corp., Sacramento, Calif. (USA)). 3 Jul 1968. 56p. Dep. NTIS $5.50.

Declassified 30 Sep 1975.

2409 (TID/SNA--3040) E-1 COMMON ANALOG MODEL. Supplement. Revision 6. Miller, J. D. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). 30 Nov 1970. Contract SNP-1. 7p. Dep. NTIS $4.00.

Declassified 19 Sep 1975.

Revision 6 of the E-1 Common Analog Model contains a few changes with respect to the core, core periphery and support systems. (LTN)

2410 (TID/SNA-3043) FLUIDIC CONTROLS FOR THE NERVA ENGINE. Fourth Semiannual Progress Report, November 1969–April 1970. (Aerojet Nuclear Systems Co., Azusa, Calif. (USA)). Aug 1970. 216p. Dep. NTIS $8.75.

Development progress of the full-flow engine fluidic control system is reported. The fluidic temperature control subsystem was transferred from IR and D status to the SNP-1 program contract 1 December 1969. Several new fluidic control concepts were explored either experimentally or analytically. Basic component and subsystem design data at simulated engine state-point conditions were secured. Component design effort during the next six months will include fabrication and simulated tests of selected "breadboard" configurations. (auth)

2411 (TID/SNA-3044) DESIGN AND DEVELOPMENT GOALS FOR NUCLEAR ROCKET ENGINES. Trent, C. H. (Aerojet-General Corp., Azusa, Calif. (USA)). 1962. 12p. Dep. NTIS $4.00.

Declassified 19 Sep 1975.

Nuclear rocket development is progressing towards a propulsive device whose operational flexibility and performance markedly transcends the capabilities of the highest performance liquid and solid propellant rocket engines. Specific design and development goals for succeeding nuclear rocket engines are: (1) Increased performance through higher reactor operating temperatures. Design goals for solid-core nuclear reactors are core-exit gas temperatures in the range of 5500°R. Reactor designs to accomodate the topping cycle are desirable. (2) Increase in engine specific thrust through decrease in reactor weight. A reasonable minimum target for power density is approximately 300 mw/ft^3. (3) Simplified engine control systems. (4) Propellant feed systems that can pump boiling hydrogen. (5) A system of self-destruction of the reactor in the event of abnormal operation. (auth)

2412 (TID/SNA-3093) SNPO-C DESIGN PRESENTATION UPGRADED THRUST CHAMBER ASSEMBLY. (Aerojet-General Corp., Sacramento, Calif. (USA)). 19 Mar 1964. 25p. Dep. NTIS $4.50.

Declassified 24 Sep 1975.

2413 FUTURE FOR NUCLEAR MARINE PROPULSION. Kinsey, R. P.; Ashcroft, D. J. (Liverpool Polytechnic). pp 82-93 of Marine Propulsion Systems Symposium. Wakefield, S. B. (ed.). London; Marine Media Management Ltd. (1975).

From symposium on marine propulsion systems; Liverpool, Eng. (23 May 1974).

The argument for nuclear propulsion in the United Kingdom is reexamined following recent changes in the cost of fuel oil. A brief outline of previous work in this field during the period 1964-71 is followed by a discussion of the basic concept of a marine reactor. Descriptions are given of a typical BPWR integral concept, including details of the reactor core and the reactor auxiliary systems, safety of reactor and personnel, in-service inspection, and refuelling. The economics of a marine reactor program are considered and the requirements for either an exclusively national program, or one of international collaboration are stated. Finally, the operational safety aspects of introducing nuclear merchant ships into world service are considered. It is concluded that nuclear propulsion machinery could favorably compete with conventional units. (UK)

Reactor Safety and Environmental Aspects

Refer also to abstracts 605, 623, 636–639, 898, and 899.

2414 (AED-CONF-75-159-001) CONTRIBUTION OF RELIABILITY ANALYSIS TO THE SAFETY OF NUCLEAR POWER STATIONS. Blombach, J.; Rosenbauer, W.; Zeibig, H. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F. R. Germany)). 1975. 18p. (In German). INIS.

From conference on technical reliability; Nuernberg, F. R. Germany (26 May 1975).

Safety concepts in engineering have helped to achieve a high degree of reactor safety. Reliability analysis can make quantitative statements on the state of safety achieved so far. These quantitative analyses also provide an appreciably better insight into the structures of systems and the interdependence between systems. The safety of these systems can thus be improved by a different layout or a different mode of operation, and, with regard to the whole system, the same safety level can be achieved for all incidents. (GE)

2415 (AEEW-M-1357) STATUS OF RELAP-UK MARK II, MAY 1975. Brittain, I.; Bryce, W. M.; Green, C. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). Sep 1975. 36p. Dep. NTIS (US Sales Only) $5.00.

Various additions and improvements which have been made to RELAP-UK since the issue of the Mark I version about a year ago are reviewed. The modifications available include: a facility for representing configurations of small pipes such as emergency cooling supply systems by pseudo-steady state approximations, an automatic representation of single phase T-junction losses in steady state solutions, evaluation of stagnation pressure and enthalpy from dynamic conditions for use in critical flow discharge tables, and improved detection of critical flow in internal connections. (auth)

2416 (ANCR-1142(Vol.1)) LOFT INTEGRAL TEST SYSTEM FINAL SAFETY ANALYSIS REPORT. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Mar 1974. Contract AT(10-1)-1375. 628p. Dep. NTIS $34.50.

The final design and safety analysis of the LOFT facility are presented. Volume I covers the experimental program, site and environment, reactor, mobile test assembly, and containment facility. (JWR)

2417 (ANCR-1142(Vol.2)) LOFT INTEGRAL TEST SYSTEM FINAL SAFETY ANALYSIS REPORT. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Mar 1974. Contract AT(10-1)-1375. 410p. Dep. NTIS $23.50.

Safety analyses are presented for the following LOFT Reactor systems: engineering safety features; support buildings and facilities; instrumentation and controls; electrical systems; and auxiliary systems. (JWR)

2418 (ANCR-1142(Vol.3)) LOFT INTEGRAL TEST SYSTEM FINAL SAFETY ANALYSIS REPORT. (Aerojet Nuclear

Co., Idaho Falls, Idaho (USA)). Mar 1974. Contract AT(10-1)-1375. 732p. Dep. NTIS $39.75.

Safety analyses are presented for the following aspects of the LOFT program: secondary coolant system; waste systems and radiation protection; operations; and quality assurance. (JWR)

2419 (ANCR-1242) DECONTAMINATION AND DECOMMISSIONING OF THE EBR-I COMPLEX. Final Report. Kendall, E. W.; Wang, D. K. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA). Idaho National Engineering Lab.). Jul 1975. Contract E(10-1)-1375. vp. Dep. NTIS $10.60.

This final report covers the Decontamination and Decommissioning (D and D) of the Experimental Breeder Reactor No. 1 (EBR-I) Complex funded under Contract No. AT(10-1)-1375. The major effect consisted of removal and processing of 5500 gallons of sodium/potassium (NaK) coolant from the EBR-I reactor system. Tests were performed to assess the explosive hazards of NaK and KO_2 in various environments and in contact with various contaminants likely to be encountered in the removal and processing operations. A NaK process plant was designed and constructed and the operation was successfully completed. Lesser effort was required for D and D of the Zero Power Reactor (ZPR-III) Facility, the Argonne Fast Source Reactor (AFSR) Shielding, and removal of contaminated NaK from the storage pit. The D and D effort was completed by 13 June 1975, ahead of schedule. (auth)

2420 (ARH-ST-112) ALLCUTS: A FAST, COMPREHENSIVE FAULT TREE ANALYSIS CODE. Van Slyke, W. J.; Griffing, D. E. (Atlantic Richfield Hanford Co., Richland Wash. (USA)). Jul 1975. Contract E(45-1)-2130. 133p. Dep. NTIS $5.75.

A description, user instructions, and a source program listing are presented for ALLCUTS, a Fortran computer code for fault tree analysis. The code was specifically designed to be easy to use as well as fast, versatile, and powerful. It may easily be modified by a moderately skilled programer to fit the variable needs of the user and the capabilities of his computer. A code, BRANCH, for determining input data gate and bottom event interrelationships is also presented. (7 references) (auth)

2421 (BAW-10101) ANTICIPATED TRANSIENTS WITHOUT SCRAM PROGRAM: COMMON MODE FAILURE ANALYSIS OF CONTROL ROD DRIVE MECHANISM. Hammond, C. W.; Oelkers, E.; Penland, J. R.; Schwartz, J. I.; Williams, J. T. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Aug 1975. 16p. Babcock and Wilcox, Lynchburg, Va.

As part of the Anticipated Transient Without Scram (ATWS) program, Diamond Power Specialty Corporation's control rod drive mechanism (CRDM) was evaluated to determine its susceptibility to common mode failure. This study qualitatively evaluates the credibility of mechanical failure of a significant number of control rods to insert into the reactor core by trip on loss of power to the CRDM stators or to achieve powered insertion if power is available to the stators. The analytical procedure is a modification of the "Extended Qualitative Analysis," Section 4.5 of IEEE Std 352-1972, 1974 Revision, "General Principles for Reliability Analysis of Nuclear Power Generating Station Protection Systems. It is concluded that a simultaneous mechanical common mode failure of the trip function in all CRDM's is incredible; furthermore, there is no credible mechanical common mode failure of both trip and powered insertion capability in all CRDMs. (auth)

2422 (CENPD-140(Amend.3)) DESCRIPTION OF THE CONTRANS DIGITAL COMPUTER CODE FOR CONTAINMENT PRESSURE AND TEMPERATURE TRANSIENT ANALYSIS. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Oct 1975. 12p. Combustion Engineering, Inc., Windsor, CT.

The equations used in CONTRANS to calculate the temperature and pressure expansion of the containment liner for annulus dual containments of cylindrical geometry are presented. The condensing heat transfer correlation used for main steam line break analysis is also discussed. (auth)

2423 (CONF-750857-1) ORNL PWR BLOWDOWN HEAT TRANSFER PROGRAM. Thomas, D. G.; Bennett, R. F.; Hedrick, R. A.; Sheppard, J. D.; Eads, B. G.; Helms, R. E.; White, J. D. (Oak Ridge National Lab., Tenn. (USA)). 1975. 22p. Dep. NTIS $4.25.

From EPRI review meeting; Washington, District of Columbia, USA (28 Aug 1975).

The PWR-Blowdown Heat Transfer Program is an experimental, separate effects, study of the relations among the principal variables that can alter the rate of blowdown, the presence of flow reversal and re-reversal, and time delay to critical heat flux, the rate at which dryout progresses, and similar time-related functions that are important to LOCA analysis. Primary test results will be obtained from the Thermal Hydraulic Test Facility (THTF), a large, non-nuclear pressurized-water loop which incorporates a 49-pin electrically heated bundle. Ancillary experiments are carried out in two additional test loops--the Forced Convection Test Facility (FCTF), a small, high-pressure facility in which single heater pins can be tested in annular geometry, and an air-water loop which is used to evaluate two-phase flow-measuring instrumentation. (auth)

2424 (CREARE-TN-214) EFFECTS OF COLD LEG STEAM AND FLOW BAFFLES ON ECC DELIVERY IN A SIMULATED MULTILOOP PWR GEOMETRY WITH STEAM UPFLOW AND SUPERHEATED WALLS. Quarterly Progress Report, April 1, 1975-June 30, 1975. Block, J. A.; Crowley, C. J. (Creare, Inc., Hanover, N. H. (USA)). Jul 1975. Contract E(11-1)-2485. 31p. Dep. NTIS $4.00.

The Creare program is studying ECC bypass and downcomer effects in a $\frac{1}{15}$-scale, planar, multiple leg injection model of a Pressurized Water Reactor. Specifically, the parameters being investigated are ECC injection, steam upflow, cold leg steam, flow baffles (as an alternate ECCS concept), and superheated downcomer walls. The work reported here involved experiments investigating the effects of cold leg steam and flow baffles, both with superheated and with saturated downcomer walls. The results of tests with cold leg steam were similar to tests injecting water of a subcooling equivalent to that of the cold leg steam/ECC water mixture in the cold legs (despite oscillations of a liquid plug in the cold legs in some cases). All three downcomer baffle designs tested helped water delivery in this facility, although it is not clear that the benefits would also occur, say, with a scaled lower plenum. 11 references. (auth)

2425 (CVI-TR-7301-A) DESIGN AND DEVELOPMENT OF THE HECA FILTRATION SYSTEM AND ITS APPLICATION IN ENGINEERED-SAFETY-FEATURE (ESF) ATMOSPHERE CLEANUP SYSTEMS. (CVI Corp., Columbus, OHIO (USA)). 25 Sep 1975. 125p. CVI Corp., Columbus, OH.

This report describes the design, development, fabrication, and testing of an Engineered-Safety-Feature (ESF) System incorporating a HECA charcoal adsorber to meet the requirements of the AEC Regulatory Guide 1.52. The design criteria, component selection, design innovations, and testing are covered in sufficient detail to convey all salient features to those familiar with this particular field of engineering. Emphasis is placed upon describing and substantiating the design of the charcoal adsorber section which exhibits a high efficiency removal capability for elemental iodine and the radioactive organic compounds of iodine. In the limit, the charcoal adsorber efficiency approaches the efficiency of the charcoal itself. This concept was realized by eliminating known or predicted objectionable design, operational, and on-site maintenance features which have collectively contributed to system efficiency ratings considerably lower than those of the charcoal, Specific means by which CVI supplied ESF Systems (when specifically designed and built in accordance with this Topical Report) satisfy the requirements of the AEC Regulatory Guide 1.52 are discussed. (auth)

2426 (HEDL-SA-741(Rev.)) HYPOTHETICAL CORE DISRUPTIVE ACCIDENT. Simpson, D. E. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jul 1975. Contract AT(45-1)-2170. 153p. Dep. NTIS $7.75.

The hypothetical core disruptive accident in an LMFBR is discussed under the following main headings: reactor dynamics; mechanical consequences; and post-accident heat removal. 79 references. (DCC)

2427 (IKE-K-36-D) THEORETICAL INVESTIGATION OF A HYPOTHETIC CORE MELTDOWN ACCIDENT. Barth, K. L. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Apr 1973. 72p. (In German). INIS.

Thesis.

Starting from a hypothetic reactor accident (primary system rupture) accompanied by a failure of the emergency cooling system, a computer system for the simulation of this maximum credible accident (MCA) in a water-cooled nuclear reactor is developed. (GE)

2428 (INIS-mf-1703, pp 343-354) CONTROL OF NUCLEAR SAFETY OF NUCLEAR POWER PLANTS. Dubovskii, B. G.; Lyubchenko, V. F. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

This paper considers present-day tendencies in nuclear power plant safety as a potential source of radiation harm to the personnel of the nuclear power plant and to the surrounding population. A number of methods are described for decreasing this

danger, and also a number of concepts are presented on instrumental protection at a nuclear power plant. (tr-SJR)

2429 (KFK-2100) METHODS OF QUANTITATIVE ANALYSIS OF NUCLEAR ENERGY HAZARDS. Status Report. Papp, R.; Caldarola, L.; Helm, F.; Jansen, P.; McGrath, P.; Weber, G. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Nukleare Sicherheit). Mar 1975. 169p. (In German). INIS.

The problem of "risk acceptance" associated with the entire nuclear fuel cycle is analyzed. Recommendations for further research work are given which are thought to be needed in order to render the methods discussed more generally applicable and accepted than they are today. (GE)

2430 (KFK-2200, pp 63-96) REDUCTION OF RESIDUAL RISKS OF PWR TYPE REACTORS. Smidt, D. Apr 1975. (In German).

In contributions to nuclear engineering.

The residual risk for the occurrence of a few serious reactor accidents is presented in accordance with the Rasmussen study. The comparison with the situation in the Federal Republic shows that especially due to the other manner of construction of the emergency cooling systems, which is described in detail, core melting accidents are clearly becoming more improbable here. On the other hand, the larger population density of the FRG necessitates less favorable sites compared to the USA and thus serious effects with hypothetical large accidents. Within the framework of the thus resulting various requirements, the safety of the reactor pressure vessel plays a considerable role and is therefore discussed in detail. (GE)

2431 (LA-6005-MS) APPLICATION OF A DRIFT-FLUX MODEL TO FLASHING IN STRAIGHT PIPES. Hirt, C. W.; Romero, N. C. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. Contract W-7405-Eng-36. 16p. Dep. NTIS $4.00.

A new computer program, SOLA-DF, has been written to solve the unsteady, two-dimensional equations of motion for a two-phase mixture. The equations solved are based on the drift-flux approximation and include a phase transition model and a general drift velocity calculation. The SOLA-DF code is used for a study of the blowdown of straight pipes initially filled with water at high temperature and pressure. Computed results are presented that show the relative importance of phase transition rates, pipe friction, drift velocity magnitude, and other model variations. The computed results are also compared with experimental data. 7 references. (auth)

2432 (MRR-138) RELIABILITY ANALYSIS AS A MORE OBJECTIVE METHOD OF EVALUATION OF TECHNICAL SYSTEMS. Bastl, W. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Jun 1974. 15p. (In German). INIS.

Available from ZAED. Publ. in Atomwirtsch., Atomtech. v. 19(10) p. 474-477, Oct. 1974.

Starting from general considerations concerning the application of reliability analysis to electronic systems some basic difficulties are discussed when using it for investigation of nuclear reactors. The constraints of a statistical approach based upon few data are shown by a simple example. Some problems are highlighted which appear in the context with common mode failures and with the as-good-as-new hypothesis. Emphasis is laid upon the necessity for an appropriate implementation of the accident dynamics in the reliability analysis. (auth)

2433 (ORNL-TM--5021(Vol.1)) QUARTERLY PROGRESS REPORT ON REACTOR SAFETY PROGRAMS SPONSORED BY THE NRC DIVISION OF REACTOR SAFETY RESEARCH FOR APRIL--JUNE 1975. I. Light-Water-Reactor Safety. (Oak Ridge National Lab., Tenn. (USA)). Sep 1975. Contract W-7405-eng-26. 108p. Dep. NTIS $5.45.

Progress is reported in the following areas of study: blowdown heat transfer; fission product beta and gamma energy release; and zirconium-water oxidation kinetics. Operations at the Nuclear Safety Information Center are reviewed. Planned multirod burst tests, LWR fuel fission product release studies, and zircaloy cladding creepdown and collapse investigations are described. (DCC)

2434 (ORNL-TM--5021(Vol.2)) QUARTERLY PROGRESS REPORT ON REACTOR SAFETY PROGRAMS SPONSORED BY THE NRC DIVISION OF REACTOR SAFETY RESEARCH FOR APRIL--JUNE 1975. II. Heavy-Section Steel Technology Program. Whitman, G. D. (Oak Ridge National Lab., Tenn. (USA)). Sep 1975. Contract W-7405-eng-26. 77p. Dep. NTIS $5.45.

Information on the heavy-section steel technology program for water cooled reactor pressure vessels is presented concerning fracture mechanics analyses and investigations, effect of high-temperature primary reactor water on the subcritical crack growth of reactor vessel steel, investigations of irradiated materials, pressure vessel investigations, thermal shock investigations, and weld heat-affected-zone cracking. (DCC)

2435 (RISO-M-1817) DYNAMIC ANALYSIS OF AIRCRAFT IMPACT USING THE LINEAR ELASTIC FINITE ELEMENT CODES FINEL, SAP, AND STARDYNE. Lundsager, P.; Krenk, S. (Danish Atomic Energy Commission, Risoe. Research Establishment). 28 Aug 1975. 18p. Dep. NTIS (US Sales Only) $4.00.

The static and dynamic response of a cylindrical/spherical containment to a Boeing 720 impact is computed using 3 different linear elastic computer codes: FINEL, SAP, and STARDYNE. Stress and displacement fields are shown together with time histories for a point in the impact zone. The main conclusions from this study are: In this case the maximum dynamic load factors for stress and displacements were close to 1, but a static analysis alone is not fully sufficient; (2) More realistic load time histories should be considered; (3) The main effects seem to be local. The present study does not indicate general collapse from elastic stresses alone; and (4) Further study of material properties at high strain rates is needed. (auth)

2436 (SAND-75-0449) EXPERIMENTAL FAST REACTOR SAFETY RESEARCH PROGRAM. Quarterly Report, April-June 1975. (Sandia Labs., Albuquerque, N. Mex. (USA)). Aug 1975. Contract AT(29-1)-789. 90p. Dep. NTIS $5.45.

Research progress is reported for the following tasks: debris bed studies; molten fuel pool studies; Prompt Burst Excursion (PBE) experiment; equation-of-state studies of reactor fuels; Annular Core Pulse Reactor (ACPR) upgrade studies; and fuel motion detection studies. (DCC)

2437 (XN-75-43) CORE PHYSICS METHODS AND DATA USED AS INPUT TO LOCA ANALYSIS. Skogen, F. B. (Exxon Nuclear Co., Richland, Wash. (USA)). Aug 1975. 47p. Exxon Nuclear Co. Inc., Richland, WA.

A description of the Exxon Nuclear Company core physics methods and the data used as input to the WREM analysis of PWR's is presented. The calculations of the important reactivity feedback effects such as those due to moderator density and Doppler are described along with discussions of scram reactivities and insertion rates. The fission heat calculational model including discussions of the reactivity feedback effects is presented. The decay heat model and the methodology for calculating gamma energy deposition are also presented. The power distribution treatment is discussed. The Appendices include neutronics input data used in the WREM analysis of the H. B. Robinson Unit 2 reactor. (auth)

2438 (XN-75-55(Rev.1)) EXXON NUCLEAR WREM-BASED NJP-BWR ECCS EVALUATION MODEL AND EXAMPLE APPLICATION TO THE OYSTER CREEK PLANT. Krysinski, T. L.; Bjornard, T. A.; Steves, L. H. (Exxon Nuclear Co., Richland, Wash. (USA)). 17 Oct 1975. 267p. Exxon Nuclear Co., Richland, WA.

A proposed integrated ECCS model for non-jet pump boiling water reactors is presented, using the RELAP4-EM/BLOWDOWN and RELAP4-EM/SMALL BREAK portions of the Exxon Nuclear WREM-based Generic PWR Evaluation Model coupled with the ENC NJP-BWR Fuel Heatup Model. The results of the application of the proposed model to Oyster Creek are summarized. The results of the break size sensitivity study using the proposed model for the Oyster Creek Plant are presented. The application of the above results yielded the MAPLHGR curves. Included are a description of the proposed non-jet pump boiling water reaction evaluation model, justification of its conformance with TOCFR50, Appendix K, the adopted Oyster Creek plant model, and results of the analysis and sensitivity studies. (auth)

2439 (XN-CC-33(A)(Rev.)) HUXY: A GENERALIZED MULTIROD HEATUP CODE WITH 10CFR50 APPENDIX K HEATUP OPTION USER'S MANUAL. Steves, L. H.; Krysinski, T. L.; Gaines, S. F.; Kahn, J. D.; Worley, L. C. (Exxon Nuclear Co., Richland, Wash. (USA)). 28 Jul 1975. vp. Exxon Nuclear Co. Inc., Richland, WA.

The HUXY code, which complies with Appendix K requirements for ECCS analysis, is described in detail. The description includes theoretical treatment, built-in physical property correlations, preparation of input, and interpretation of output. The principal modifications to MOXY/MODO01 resulting in HUXY are listed. An example of a HUXY analysis in accordance with Appendix K of 10CFR50 is presented. (auth)

2440 (YAEC-1086) CONTAINMENT PRESSURE ANALYSIS MODEL USING CONTEMPT-LT. Gupta, R. N. (Yankee Atomic

Electric Co., Westboro, Mass. (USA)). Sep 1975. 35p. Yankee Atomic Electric Co., Westboro, MA.

An analytical model for evaluating the reactor containment pressure transient following a loss-of-coolant accident (LOCA) is presented. The model uses the CONTEMPT-LT computer program developed by Aerojet Nuclear Company. The sample problem studied is the containment response following the most severe postulated LOCA at the Yankee Rowe Nuclear Power Station. The results show good agreement with the response predicted by Westinghouse Electric Corporation. (auth)

2441 OPERATION SAFETY OF NUCLEAR REACTORS. Pfann, J. Nukleon.; No. 2, 35-39(Sep 1974). (In Czech).

Safety problems of nuclear reactor operation are briefly reviewed. The risks to the environment resulting from nuclear reactor operation are discussed and measures aimed at reducing the risks are described. A research programme related to the problems of reliable and safe operation of nuclear power reactors as conducted by the Institute of Nuclear Research, Řež, is outlined. (auth)

2442 NUCLEAR ENERGY AND THE ENVIRONMENT. Roux, A. J. A. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). SASSAR.; 261, 263(Apr 1973).

The nuclear power industry is developing in an era during which much attention is being given to the preservation of public health and environmental quality. At the very low levels of radiation to which members of the public are exposed the incidence of effects is so low as to be not observable, as a result it is possible neither to prove nor disprove the actual occurrence of effects at these levels. In a recent report by the special Cabinet Committee on pollution in the RSA, it was clearly evident that of all forms of pollution in this country, that of radioactivity — whether it be from radioactive isotopes used in medicine and industry, or from the Pelindaba research reactor — was best under control in this country. (INIS)

2443 REPRODUCTIVE CYCLES OF LARGEMOUTH BASS (MICROPTERUS SALMOIDES) IN A COOLING RESERVOIR. Bennett, D. H.; Gibbons, J. W. (Savannah River Ecology Lab., Aiken, SC). Trans. Am. Fish. Soc.; 104: No. 1, 77-82(Jan 1975).

Annual reproductive cycles of largemouth bass (Micropterus salmoides) collected in the heated area of a 1120-hectare reservoir receiving thermal effluent from the Savannah River Plant were similar to cycles from bass collected in unheated waters during 1969 and 1970. Average maximum monthly temperatures at the heated area exceeded those in unheated waters by greater than 10^0C for the 2 years. Few monthly differences in gonosomatic indices were found between heated and unheated areas. Earlier attainment of maximum gonadal size and the presence of significantly larger juvenile bass at the heated area suggested that reproduction might be accelerated by thermal discharge. However, gonadal condition indicated that the reproductive period started in March and continued through April in both areas. Reproduction may have been advanced in some heated-area bass, although this was not obvious from overall changes in the reproductive cycles of bass from unheated areas. (auth)

2444 LIQUID METAL FAST BREEDER REACTOR: AN ENVIRONMENTAL AND ECONOMIC CRITIQUE. Cochran, T. B. Washington, DC; Resources for the Future (1974). 279p. Johns Hopkins University Press, Baltimore, MD.

Economic and environmental arguments made by the AEC and others for the liquid metal fast breeder reactor (LMFBR) as a central component of the U. S. electrical energy system are discussed. The LMFBR appears to have no environmental advantage over the currently operating light water reactor and especially not over the high temperature gas reactor. The principle environmental argument for the rapid introduction of LMFBRs is that they will provide a virtually inexhaustible fuel source, and reduce the demand for strip-mining the limited reserves of high grade U ore. A 20-yr delay in the construction of LMFBRs would result in an increase of only 50 mi^2 of strip mining over the next 50 yr, and the cost of reclamation of this land would be about 0.1 mill/kw-hr. Uranium from which fuel has been extracted for use by nonbreeder reactors can still be used by breeders, thus breeders could still be introduced in the future, if fusion is not developed in time, and extract the same overall energy from a given supply of U as if they had been introduced earlier. Economic arguments in favor of the LMFBR are based on models highly sensitive to changes on some of the most critical input variables: nuclear power plant capital costs, fuel cycle costs, performance characteristics of LMFBR designs, electrical energy demand, and U ore costs. There is no basis for concluding that the LMFBR will be economical in the 1980s or early 1990s. (Pollut. Abstr.)

2445 NUCLEAR POWER IN THE UNITED KINGDOM ENVIRONMENT. Pocock, R. F. (Institution of Nuclear Engineers, London). J. Inst. Nucl. Eng.; 16: No. 3, 76-78; 88(May 1975).

A discussion is presented of the environmental effect of existing reactors and those proposed for the remainder of the century. It is concluded that nuclear power has a number of unavoidable disadvantages, but should nevertheless be more acceptable than other alternative energy sources. Matters discussed include the nuclear safety problem, active waste disposal, and transport and storage of fuels and wastes. (UK)

2446 AS LOW AS PRACTICABLE. Dunster, H. J. (National Radiological Protection Board, Harwell, Eng.). Radiol. Prot. Bull.; No. 12, 16-17(Jul 1975).

A summary is given of the US Nuclear Regulatory Commission's Docket No. RM-50-2 (issued 30 April, 1975), "The Opinion of the Commission in the Matter of Rulemaking Hearing — Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as Practicable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents." Numerical definitions of the phrase 'as low as practicable' are slightly different from those in earlier proposals and in the relevant environmental statements (Radiol. Prot. Bull., No. 7, April 1974). The figures for liquid and gaseous effluents, and the limiting cost-benefit value per man rem out to a distance of 50 miles requiring the installation of any item of waste management equipment, are listed. Conclusions are given on some of the interpretative points associated with the models used in assessing the release limits and in determining the design objectives by cost-benefit analysis. These models should be based on data chosen so that it is unlikely that the true dose would be underestimated substantially. Environmental and behavior models should represent real situations and take into account only such situations as can actually occur during plant operation, thus excluding what are described as bizarre characteristics. (UK)

2447 FAST RESPONSE MULTI-BEAM X-RAY ABSORPTION TECHNIQUE FOR IDENTIFYING PHASE DISTRIBUTIONS DURING STEAM-WATER BLOWDOWNS. Smith, A. V. (United Kingdom Atomic Energy Authority, Foulness, Eng.). J. Br. Nucl. Energy Soc.; 14: No. 3, 227-235(Jul 1975).

The use of a multi-beam X-ray absorption technique for transient density measurement of two-phase blowdown flows is described. The observed response time is less than 1 msec. At a fixed location, five measurement beams simultaneously passed through a cross section of the pipe and their transmitted intensities are recorded together with those of two reference beams. The results of blowdown investigations with a water-filled pipe at an initial pressure and temperature of 57 bar (gauge pressure) and 242°C are presented. They are interpreted as indicating the existence during blowdown of a vapor annulus in contact with the internal pipe surface surrounding an inner core of two-phase mixture. The mixture itself is found to approximate to homogeneous conditions for the early part of the blowdown. The technique reveals that the average void fraction over the pipe cross-sectional area for such a distribution can be up to a factor of two greater than that indicated by a single diametral X-ray beam. (auth)

2448 STUDY ON EMERGENCY CORE COOLING. Ishii, M. (CEN, Grenoble, France). J. Br. Nucl. Energy Soc.; 14: No. 3, 237-242(Jul 1975).

A two-dimensional conduction model based on thermal penetration depth is described, and proposed models for transient boiling heat transfer are presented. (auth)

2449 INVESTIGATION OF SOME ASPECTS OF FLOW INTO GAS COOLED NUCLEAR REACTORS FOLLOWING AN ACCIDENTAL DEPRESSURIZATION. Leach, S. J.; Thompson, H. J. Br. Nucl. Energy Soc.; 14: No. 3, 243-250(Jul 1975).

A situation that may occur following a depressurization accident caused by a breach in the heat exchanger circuit of a Magnox reactor is discussed. After the pressure within the reactor has fallen to that of the atmosphere, buoyancy forces may cause an outward flow of gas and an inward flow of air. Results are presented of model experiments, and empirical formulae are given for calculating the rate of flow that may be induced by buoyancy forces and the purging flow rate of carbon dioxide that is necessary to prevent the ingress of further air. (auth)

2450 STUDIES TO THE FORMATION OF WATER GAS IN HTR-REACTOR INCIDENTS FOR THE EXAMPLE OF A PLANNED HOT GAS TEMPERATURE INCREASE TO 950°C AT THE AVR-REACTOR. Wischnewski, R. Aachen; Technische Hochschule (1973). 107p. (In German). INIS.

Thesis.

The possibility is studied that the planned hot gas temperature increase leads — in the case of the maximum credible accident or the so-called "hypothetical incident" — to critical water gas concentrations in the containment and thereby to possible hazards for the environment. (GE)

2451 STOCHASTIC METHOD FOR THE SEISMIC ANALYSIS OF BUILDINGS WITH APPLICATION TO NUCLEAR POWER PLANTS. Damrath, R. Berlin; Technische Univ. (1974). 191p. (In German). INIS.

Thesis.

A survey of the problems of seismic analysis of nuclear power stations is presented. Different models for earthquakes and dynamic systems are discussed. Deterministic and stochastic solution processes are described and discussed by examples. (GE)

2452 RADWASTE FILTRATION AND PARTICLE DISTRIBUTION. Lancey, T. W.; van den Berg, T. (California State Univ., Fullerton). Mater. Performance; 13: No. 12, 28-31(Dec 1974).

Nuclear power plant radwaste systems remove a variety of materials including corrosion products, resins, detergents, filter materials, dusts, and organic materials. The types, sources, and size distribution of solid particulate matter present in radwaste water streams are evaluated. It is concluded that the filter element micron rating should be approximately three times the particle size at peak concentration to assure both high porosity and efficient filtration. (HDR)

2453 NUCLEAR POWER SAFETY: AN ENGINEERING OVERVIEW. Hocevar, C. J. Prof. Eng.; 25-29(May 1975).

Safety considerations for the design of nuclear power plants are reviewed. Potential radiation hazards from nuclear power plants and fuel reprocessing plants are discussed. (DCC)

Reactor Theory and Calculation

Refer also to abstract 2311.

2454 (CEA-N-1793) APPLICATION OF THE GALERKIN'S METHOD TO THE SOLUTION OF THE ONE-DIMENSIONAL INTEGRAL TRANSPORT EQUATION: GENERALIZED COLLISION PROBABILITIES TAKEN IN ACCOUNT THE FLUX GRADIENT AND THE LINEARLY ANISOTROPIC SCATTERING. Sanchez, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service d'Etudes des Reacteurs et de Mathematiques Appliquees). Apr 1975. 213p. (In French). Dep. NTIS (US Sales Only) $13.75.

Thesis. Submitted to Univ. of Paris, Orsay.

For the one-dimensional geometries, the transport equation with linearly anisotropic scattering can be reduced to a single integral equation: this is a singular-kernel FREDHOLM equation of the second kind. Applying a classic projective method, that of GALERKIN, to the solution of this equation gives the well-known collision probability algorithm: piecewise polynomial expansions are used to represent the flux. In the ANILINE code, the flux is supposed to be linear in plane geometry and parabolic in both cylindrical and spherical geometries. An integral relationship between the one-dimensional isotropic and anisotropic kernels was found; this reduces the new matrix elements (issuing from the anisotropic kernel) to classic collision probabilities of the isotropic scattering equation. For cylindrical and spherical geometries an approximate representation of the current was used to avoid an additional numerical integration. Critical radii and albedos have been calculated for homogeneous slabs, cylinders and spheres. For heterogeneous media, the thermal utilization factor obtained was compared with the theoretical result based upon a formula by BENOIST. Finally, ANILINE has been incorporated into the multigroup APOLLO code, which permitted analysis of the MINERVA experimental reactor in transport theory with 99 groups. The ANILINE method is particularly suited to the treatment of strongly anisotropic media with considerable flux gradients. It is also well adapted to the calculation of reflectors, and in general, to the exact analysis of anisotropic effects in large-sized media. (auth)

2455 (JPRS-65914) SCIENTIFIC AFFAIRS NO. 480. 14 Oct 1974. Translation of Eastern Europe Scientific Affairs No. 480. 40p. NTIS.

The report contains articles concerning the development of and progress in the various theoretical and applied scientific disciplines and technical fields; and the administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences. (auth)

2456 (NEANDC(E)-163U, pp 43-62) EVALUATION OF THE THORIUM-232 CAPTURE RESONANCE INTEGRAL. Greneche, D. (Cen, Saclay, France). Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

From the view point of a reactor physicist, the most important quantity to be established for a fertile nucleus is without any doubt the resonance integral on which the conversion ratio depends in particular. A set of evaluated resonance parameters is proposed on the basis of measurements published by different laboratories. A comparative study is presented in which the values of the resonance integral in infinite dilution, calculated by means of different sets of parameters, are compared with experimental values obtained from integral measurements. For this purpose, a compilation of measurements was prepared in order to determine the "best" value as reference for comparisons. (auth)

2457 (NEANDC(E)-163U, pp 291-295) TEMPERATURE COEFFICIENTS IN THE THERMAL REACTORS. Le Coq, G.; Reuss, P. Jan 1975.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

In specialists meeting on resonance parameters of fertile nuclei and ^{239}Pu.

The temperature coefficient of a reactor is defined as the logarithmic derivative of the multiplication factor k with respect to the temperature: $\alpha = (1/k)\,(\partial k/\partial T)$. It is generally expressed in "pcm per degree". Some comparisons have been made for graphite or water moderated lattices: it appears a discrepancy of about 2 pcm/° (calculation < experiment) at room temperature. This difference decreases at higher temperature. (auth)

2458 (VTT-YDI-4) CORRE: A COMPUTER CODE FOR CRITICAL HEAT FLUX AND VOID FRACTION CALCULATION. Rastas, A. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Jun 1973. 52p. Dep. NTIS (US Sales Only) $5.75.

A computer code for critical heat flux and boiling void fraction calculations is described. Pertinent correlations are optionally available and the modular structure of the code facilitates the incorporation of new correlations in the program. Standard input and output instructions are included. (auth)

2459 (VTT-YDI-6) FORM: A MULTIGROUP CODE FOR CALCULATING THE FUNDAMENTAL MODE FLUX AND CURRENT SPECTRA OF FAST NEUTRONS. Siltanen, P. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Aug 1973. 84p. Dep. NTIS (US Sales Only) $7.25.

Certain additions and programming changes have been introduced in the multigroup slowing down code MUFT. The revisions pertain to resonance and heterogeneity effects. Complete input and output specifications are included. The code is designed for UNIVAC 1108 computer. 12 references. (auth)

2460 (VTT-YDI-10) THERMOS-OTA: A REVISED VERSION OF THE THERMOS PROGRAM FOR THERMAL LATTICE CALCULATIONS WITH THE AUXILIARY PROGRAMS THEPSL AND THECOM. Saastamoinen, J.; Wasastjerna, F. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Jan 1974. 51p. Dep. NTIS (US Sales Only) $5.75.

The computer program THERMOS-OTA is described which is an improved version of the THERMOS program written by Honeck. THERMOS-OTA uses the collision probability method to solve the integral transport equation for the thermal neutron density in slab or cylindrical geometry. Condensed cross section sets can be obtained for various nuclides and mixtures and can be stored in mass storage as pseudo-material libraries. The auxiliary programs THEPSL and THECOM are used to manipulate these libraries. 14 references. (auth)

2461 (VTT-YDI-16) IRESINT-3, A FORTRAN PROGRAM FOR COMPUTATION OF RESONANCE INTEGRALS. Hoeglund, R.; Wasastjerna, F. (Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Ydinvoimatekniikan Lab.). Jan 1975. 149p. Dep. NTIS (US Sales Only) $10.50.

IRESINT-3 computes the resonance absorption of neutrons in a square or hexagonal lattice of infinitely long clad fuel rods. The rods may be grouped into fuel elements separated by gaps. Up to 5 absorbers, 2 admixed moderators, 1 cladding nuclide and 3 external moderators may be present. Resonance overlap may be taken into account. A wide variety of computational options is available including six different versions of the IR approximation. (auth)

2462 UNDERSTANDING CHAIN REACTIONS. Srinivasan, M. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). Sci. Today (Bombay).; 9: No. 3, 13-16(Sep 1974).

The phenomenon of nuclear fission and the parameters associated with fission and chain reactions such as fission cross section, capture cross section, neutron multiplication factor K, and criticality etc. are explained. The importance of the multiplication factor K in deciding a reactor system to be critical

(K = 1) or supercritical (K > 1) or sub-critical (K < 1) is pointed out. By maintaining K ≃ 1 a chain reaction is controlled as in a nuclear reactor. If K exceeds 1.002 the divergent chain reaction results in a nuclear explosion. Use of moderators to achieve controlled reaction is mentioned. Mention is also made of the principle of fast breeder reactors. (INIS)

2463 THE DOPPLER EFFECT IN FAST REACTORS. Bhatti, R. A.; Mannan, M. A. (Pakistan Atomic Energy Commission, Karachi). Nucleus (Karachi).; 11: No. 1,2, 3-12(Jan 1974).

A review is made of calculation methods for estimating the doppler effect in fast reactors. The minimum amount of capturing isotope ^{238}U is calculated that must be mixed with fissile isotope ^{235}U in order to ensure negative net value of temperature coefficient of reactivity for 100 keV neutrons at a temperature of 625°K. It is found that the ratio of ^{238}U to ^{235}U nuclei must be larger than 1.9 for ensuring negative temperatures coefficient of reactivity. (INIS)

2464 THE SIGNIFICANCE OF SPATIAL REACTOR KINETICS IN THE ANALYSIS OF TRANSIENTS. Otcenasek, P. Jad. Energ.; 20: No. 8, 280-285(Aug 1974). (In Czech).

Lecture read at the Faculty of Nuclear Physics and Engineering of the Czech Technical University in the summer semester of 1974.

Relations are presented for the calculation of non-stationary neutron fields. Transitions from the non-stationary transport equation to point kinetics equations are discussed. (INIS)

2465 A METHOD FOR THE DETERMINATION OF THE REACTIVITY OF A SUB-CRITICAL SYSTEM FORMED FROM TWO IDENTICALLY COUPLED CORES. Tai, A. S. (Ecole Polytechnique, Lausanne (Switzerland). Lab. de Genie Atomique). Z. Angew. Math. Phys.; 25: No. 5, 690-693(25 Sep 1974). (In French).

From Swiss Physical Society spring meeting; Bern, Switzerland (26 Apr 1974).

Considering the Laplace transform of the two multiplying zones kinetic equations and taking account of the neutron transfer time distribution, it is shown that the ratio between the neutron evolution function integral of the active zone and that of the passive one is a useful value. For symmetrical systems (two identical zones) in particular, this ratio allows one to obtain the ratio between the whole reactivity and the coupling reactivity, and even the whole reactivity (in $) in some cases. (auth)

2466 INTEGRODIFFERENTIAL SYSTEM OF EQUATIONS OF REACTOR KINETICS. Kuznetsov, Yu. A.; Morozov, S. F. (Gorky State Univ., USSR). Differ. Uravn.; 10: No. 8, 1491-1503(Aug 1974). (In Russian).

Theorems of existence and uniqueness are established for solutions in various functional classes for a nonstationary integro-differential system of equations of reactor kinetics, and evaluations of the solutions are given. (JPRS)

2467 HIGH-ORDER RESPONSE MATRIX EQUATIONS IN TWO-DIMENSIONAL GEOMETRY. Weiss, Z.; Lindahl, S. O. (ASEA-ATOM, Vaesteras, Sweden). Nucl. Sci. Eng.; 58: No. 2, 166-181(Oct 1975).

Response matrix equations in two-dimensional geometry have been derived in the form of a set of coupled integral equations of the Fredholm type that have been solved by the moments method. The set of Legendre polynomials defined at the material interfaces has been chosen as the base for representing the partial interface currents and the response matrices. The method has been applied to the solution of the one-group diffusion equation and its convergence has been investigated in a series of numerical experiments, involving expansions of up to order 14. It turned out that the P_1 approximation should be adequate for the majority of the two-dimensional problems occurring in power reactor design. Furthermore, the response method has a substantially higher computer efficiency than the finite difference method, both in processor time and in storage locations. As a by-product, the nature of the singularities around edges and corners of material interfaces has been analyzed by numerical experimentation. (auth)

2468 LEAKAGE ITERATIVE METHOD FOR SOLVING THE THREE-DIMENSIONAL NEUTRON DIFFUSION EQUATION. Naito, Y.; Maekawa, M.; Shibuya, K. (Japan Atomic Energy Research Inst., Tokai). Nucl. Sci. Eng.; 58: No. 2, 182-192(Oct 1975).

A new iterative method is proposed for solving the three-dimensional neutron diffusion equation. This method reduces the discretization error in the calculation of neutron leakage from a subregion. In addition, when only one fine-mesh point is located in each subregion, this method becomes the same as a fine-mesh finite-difference approximation method. Therefore, it is easy to compare the results of this method with those of a fine-mesh difference approximation. The computer code for this method can be used for calculating both the collapsed neutron flux and fine-mesh difference approximations. The conditions for the convergence of this iterative technique are introduced as a function of the neutron leakage. (auth)

2469 NUMERICAL METHOD FOR SOLVING INTEGRAL EQUATIONS OF NEUTRON TRANSPORT. II. Loyalka, S. K.; Tsai, R. W. (Univ. of Missouri, Columbia). Nucl. Sci. Eng.; 58: No. 2, 193-202(Oct 1975).

In a recent paper it was pointed out that the weakly singular integral equations of neutron transport can be quite conveniently solved by a method based on subtraction of singularity. This previous paper was devoted entirely to the consideration of simple one-dimensional isotropic-scattering and one-group problems. The present paper constitutes interesting extensions of the previous work in that in addition to a typical two-group anisotropic-scattering albedo problem in the slab geometry, the method is also applied to an isotropic-scattering problem in the x-y geometry. These results are compared with discrete S/sub N/ (ANISN or TWOTRAN-II) results, and for the problems considered here, the proposed method is found to be quite effective. Thus, the method appears to hold considerable potential for future applications. (auth)

2470 TWO-DIMENSIONAL FINITE ELEMENT METHOD FOR INTEGRAL NEUTRON TRANSPORT CALCULATIONS. Lewis, E. E.; Miller, W. F. Jr.; Henry, T. P. (Northwestern Univ., Evanston, IL). Nucl. Sci. Eng.; 58: No. 2, 203-212(Oct 1975).

A spatial finite element method is formulated for neutron transport calculations in two-dimensional reactor lattice cells in x-y geometry. The method is closely related to classical integral transport techniques in that scalar flux equations result that are similar in form to those of collision probability methods. The use of triangular spatial elements permits flexible geometrical representation of material regions, including regions with curved interfaces. On a rectangular domain, a block inversion technique provides for the incorporation of exact-reflected boundary conditions into the transport kernel. The method is implemented in a computer code and illustrated in a series of lattice cell calculations. (auth)

2471 FIRST-FLIGHT ESCAPE PROBABILITY FOR A THREE-REGION SPHERICAL BODY. Williams, M. M. R. (Queen Mary Coll., London). Nucl. Sci. Eng.; 58: No. 2, 252-253(Oct 1975).

The first-flight escape probability of a sphere containing a central black zone has been calculated making use of Marshak's expression for the flux in an infinite medium separated by a gap from a black sphere. The results are in agreement with those obtained differently by Smith and Murray and by Lefvert. (auth)

2472 CRITICAL REACTOR PROBLEM FOR A REFLECTED SLAB. Siewert, C. E.; Burkart, A. R. (North Carolina State Univ., Raleigh). Nucl. Sci. Eng.; 58: No. 2, 253-255(Oct 1975).

The elementary solutions of the one-speed transport equation are used, along with certain invariance principles, to establish tractable solutions to reflected reactor critical problems in plane geometry. (auth)

2473 CRITICAL HEAT TRANSFER IN TUBULAR FUEL ELEMENTS OF NUCLEAR POWER REACTORS. Subbotin, V. I.; Alekseev, G. V.; Peskov, O. L.; Sapankevich, A. P. Therm. Eng.; 21: No. 9, 33-39(Sep 1974).

Translated from Teploenergetika; 21: No. 9, 24-29(Sep 1974).

Studies were conducted of the dependence of critical heat flux on dimensions and cross section averaged parameters of electrically heated tubes. Results indicate that the attainment of critical conditions is not accompanied by sharp temperature increase at the heat transfer surface, suggesting the possibility of convective heat removal by wet steam instead of by steam-water mixture. (DG)

2474 SHUTDOWN HEATING. Tobias, A. (Central Electricity Generating Board, Berkeley, CA). Ann. Nucl. Energy; 2: No. 1, 3-10(Jan 1975).

The computer codes FISP and HYLAS have been used to simulate typical Magnox, AGR, HTR, SGHWR and CFR operation in order to produce shutdown heating curves for both fission products and actinides. The computed heating curves have been compared with those in common use in order to assess the reliability of the latter. Deficiencies in the curves presently in use have been identified. It has been shown possible to provide an alternative method of estimating shutdown heating which overcomes these deficiencies. (auth)

2475 SOLUTION OF GROUP DIFFUSION FOR x-y GEOMETRY BY FINITE FOURIER TRANSFORMATION. Kobayashi, K. (Kyoto Univ.). Ann. Nucl. Energy; 2: No. 1, 11-16(Jan 1975).

A new difference equation to the two dimensional diffusion equation for x-y geometry is derived by using the finite Fourier transformation. This difference equation has a form of a coupled equation of the 3 point difference equations for each coordinate, and can be easily solved by the iterative method of the alternative direction implicit method. Group diffusion equations are solved using this difference equation, and sample calculations show that accurate results can be obtained with fewer mesh points than the usual 5 points difference equation. (auth)

2476 METHOD FOR THE ANALYSIS OF REACTOR NOISE BY SIMULATION OF WELL-KNOWN MEASURING METHODS WITH A DIGITAL COMPUTER AND ITS APPLICATION TO A ROSSI-α-EXPERIMENT. Hoffmann, K. Darmstadt, Ger.; Technische Univ. (1972). 83p. (In German). INIS.

Thesis.

A method of measurement is described which allows full application of a single data system for all experiments based on the analysis of the pulse train of a neutron counter in a subcritical thermal reactor. With this method, the pulse intervals are measured digitally and stored to tape in a special compressed format. The tape is then processed by computer programs which simulate the experiments. This separation of measurement and processing eliminates all problems of dead time, limited storage capacity or too complex processing regulations. The Rossi-α-experiment is used as an example to show that simulation confirms the result of other authors. (GE)

2477 ELEMENTS OF CHEMICAL KINETICS AND REACTOR CALCULATIONS: A SELF-PACED APPROACH. Fogler, H. S. Englewood Cliffs, NJ; Prentice-Hall (1974). 511p. $21.00.

A book is presented which is intended as an introduction to chemical kinetics and reactor design. The book is written in a programmed form, and includes problems at the end of the chapters. A summary is provided for each chapter and graphical procedures in reactor sizing and analysis of reaction data are given strong presentations. (DG)

2478 MULTIPLE INPUT ANALYSIS OF A POWER REACTOR. Bloemker, C. F. Raleigh, NC; North Carolina State Univ. (1974). 140p. University Microfilms Order No. 75-15,925.

Thesis (Ph. D.).

A nuclear power system was analyzed in two ways: (1) as a single input system; (2) as a multiple input system. From these analyses, it was shown that it is necessary to use a multiple input approach to analyze a power reactor. For both single and multiple input analyses, three parameters were considered as the input variables; the primary coolant flow, the primary average line pressure, and the neutron flux. The single input transfer functions and the parameters necessary to compute the multiple input transfer functions were obtained from a modified version of ORNL's CROSSPOW program. The results show that the primary coolant flow and the neutron flux are the dominant parameters driving the primary coolant temperature. The multiple and single input transfer functions were found to differ in shape. The multiple input transfer functions were found to agree with a set of theoretical transfer functions obtained from a lumped parameter model of the reactor's thermal system. Based on this agreement, it was determined that it is necessary to use a multiple input approach when analyzing a power reactor. The cross-correlation curves revealed an oscillation with a period of four to five seconds. An investigation of the PSDs of the primary coolant flow and pressure revealed an attenuation of the PSDs at about 0.28 Hz. An investigation of Ivanjack's results showed similar attenuation in the PSDs of the secondary steam pressure and megawatt output. Based on Ivanjack's overall plant transfer function, it was hypothesized that the source of this attenuation is in the secondary system. (Diss. Abstr. Int., B)

2479 EXISTENCE, UNIQUENESS, UPPER AND LOWER BOUNDS OF SOLUTIONS OF NONLINEAR SPACE-TIME NUCLEAR REACTOR KINETICS. Chan, C. Y. (Florida State Univ., Tallahassee). SIAM (Soc. Ind. Appl. Math.) J. Appl. Math.; 27: No. 1, 72-82(Jul 1974).

A semilinear parabolic equation describes the neutron flux in a one-region cylindrical configuration. Steration schemes establish existence of maximal and minimal solutions, and a quasilinearization method is used to construct a sequence which converges uniformly to the solution. (DG)

Reactor Components and Accessories

Refer also to abstracts 546, 547, 1328, and 2553.

2480 (AECC-1(Amend.2)) FLUID BED DRYER AND AEROPEP SOLIDIFICATION SYSTEM. (Aerojet Energy Conversion Co., Sacramento, Calif. (USA)). 30 Sep 1975. vp. NUREG.

Performance measurements were made on the model of the Fluidized-bed Calciner developed by Aerojet Liquid Rocket Co. The measurements were made over the period August 11-19, 1975, at the Sacramento location of the calciner. The purpose of the tests was to evaluate the performance of the ALRC Fluidized Bed Concentrator for the processing of simulated waste containing realistic concentrations and chemical forms of radioiodine. (auth)

2481 (AED-CONF-75-159-000, pp 221-227) APPLICATION POSSIBILITIES OF ANALYTICAL METHODS IN THE RELIABILITY ANALYSIS OF TECHNICAL SYSTEMS. Richter, G.; Memmert, G. 1975. (In German).

From conference on technical reliability; Nuernberg, F. R. Germany (26 May 1975).

In conference 1975: technical reliability.

A summarizing report is given on (1) application of the reliability analysis for the quantitative safety assessment, for the determination of weak positions, investigation of operational and maintenance strategies, assessment of alternative design concepts; (2) installation conditions of the reliability programs; (3) calculation processes for the determination of reliability characteristics and to determine the sectional amounts (truth table, success paths). Availability calculations for a 4-loop emergency system and calculations of three design concepts of the station service system are quoted as examples. (GE)

2482 (AED-CONF-75-159-002) IMPORTANCE AND PROBLEMS OF ERROR DETECTION AND REPAIR FOR THE RELIABILITY OF REDUNDANT SYSTEMS. Blaess, B. (Siemens A. G., Karlsruhe (F. R. Germany)). 1975. 7p. (In German). INIS.

From conference on technical reliability; Nuernberg, F. R. Germany (26 May 1975).

Available from ZAED.

The mathematical reliability analysis arrives at the conclusion that it is not only regular maintenance and repair work which provides reliable operation of a redundant system but that the care taken during repair has a significant influence on the efficiency of the whole system. (GE)

2483 (BAW-10108) QUALIFICATION OF SUBMERGED-ARC NARROW STRIP CLADDING PROCESS. Ayres, P. S.; Gottschling, J. D.; Jeffers, G. K. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Aug 1975. 40p.

An unique narrow strip cladding process for use on both plate and forging material for nuclear components was developed. The qualification testing of this low-heat input process for cladding nuclear components, including those of SA508 Class 2 material is described. The theory that explains the acceptable results of these tests is also given. (auth)

2484 (BNL-20368) FAILURE PROBABILITIES OF STEAM GENERATOR TUBES. Annual Report. Reich, M. (Brookhaven National Lab., Upton, N. Y. (USA)). Aug 1975. 128p. Dep. NTIS $7.00.

BNL's efforts focused on the following specific items; the probabilities of failure for perfect steam generator tubes, the probabilities of failure for steam generator tubes containing long axisymmetrically thinned sections, and the probabilities of failure for steam generator tubes containing finite length (relatively short) axisymmetric wastages. (auth)

2485 (BNWL-B-446) REVIEW AND EVALUATION OF INFORMATION ON THE THERMAL PERFORMANCE OF ULTIMATE HEAT SINKS: SPRAY PONDS AND COOLING PONDS. Drake, R. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1975. 280p. Dep. NTIS $7.60.

A report is presented which identifies and evaluates available information and data useful in validating and improving existing models for the thermal performance of ultimate heat sinks. Included are discussions of the thermal elements of cooling ponds and spray ponds, the available information and data pertinent to the problem, and the requirements and needs for further research and performance data. An outline is presented of the necessary elements required for a performance test of an ultimate heat sink before the system is thermally approved. (auth)

2486 (INIS-mf-1702, pp 52-72) STUDY ON THE REGULARITIES OF CORROSION PRODUCT, TRANSFER, AND FORMATION OF DEPOSITS ON THE INNER SURFACES OF WATER-COOLED POWER REACTOR CIRCUITS AND ON CONDITIONS TO PREVENT THEIR FORMATION. Slyusarev, P. N.; Beloborodov, V. V.; Ovechkin, D. M. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

A short review is presented of the problem of forming corrosion-product deposits from the aqueous heat transfer medium on the inner surface of the reactor loops of a nuclear power plant, and also the conditions required for avoiding these deposits. The essential details of the effect of charged nuclear particles and electrons, in particular beta particles, on the rate of formation of corrosion-product deposits in radioactive loops of a nuclear power plant are discussed. (tr-SJR)

2487 (INIS-mf-1703, pp 16-27) BEHAVIOUR OF STRUCTURAL MATERIALS IN NUCLEAR POWER REACTORS COOLED WITH SODIUM. Balandin, Yu. F.; Shurakov, S. S.; Starkov, O. V.; Trapeznikov, Yu. M.; Umnyashkin, E. V.; Ivanov, V. A. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

This paper reports the results of corrosion and thermomechanical tests of austenitic steels 1 Cr18 Ni9, 1 Cr16 NM11 MZB and perlithic steels 1 Cr 2M and 1 Cr 2MFV used as construction materials in sodium-cooled reactors. Nomographs are constructed with the following coordinates: temperature versus time allowing changes in the properties of construction materials as a result of corrosion processes in sodium and water, and as a result of thermomechanical processes. On making a comparative estimate, a determination was made of the critical properties of construction materials which hold back an increase in power and operability because of nonreliability of the materials of construction. (tr-SJR)

2488 (INIS-mf-1703, pp 90-98) SOME PROBLEMS IN NUCLEAR POWER PLANT EQUIPMENT STRENGTH. Dollezhal, N. A.; Shatskaya, O. A.; Egorov, M. E.; Rivkin, E. Yu.; Filatov, V. M. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

This paper illuminates the basic strength aspects of the most critical pieces of equipment in nuclear power reactors. The basic features of estimating the strength of nuclear power equipment are formulated. Methods of solving strength problems are shown for examples of uranium-graphite and water-water reactors. Standards of designing for strength are characterized. Principles of setting up the standards and the order of estimating the strength are described. The relation between the standards, rules of construction and safe operation of the equipment is indicated. The substantial development in problems of strength in reactor construction is emphasized. The role of strength in assuring operability and long life of the equipment is indicated. The basic problems which must be solved in the future are characterized. (tr-SJR)

2489 (KFK-2165) ANNUAL PROGRESS REPORT, 1974. Kaempffer, R.; Wilhelm, J. G. (eds.). (Kernforschungszentrum Karlsruhe (F. R. Germany). Lab. fuer Filtertechnik). Jun 1975. 38p. (In German). Dep. NTIS (US Sales Only) $5.00.

This annual progress report covers work performed at LFT in 1974. The activities outlined include: development of post-accident recirculation filters; development of exhaust air filters for reprocessing plants; identification of iodine compounds; and filtering reactor exhaust air. (auth)

2490 LOCAL MANUFACTURE OF MECHANICAL COMPONENTS OF NUCLEAR POWER PLANTS IN DEVELOPING COUNTRIES. Butt, P. (Pakistan Atomic Energy Commission, Karachi). Nucleus (Karachi).; 11: No. 3, 39-54(Jul 1974).

Taking KANUPP as a model nuclear power plant and Pakistan as a model developing country, a case is made for the local manufacture of certain mechanical components of a nuclear power plant. The economics and technical feasibility of local manufacture of these components is discussed. Recommendations are made on the steps necessary to begin local manufacture. (INIS)

2491 MATERIALS FOR REACTOR LARGE-SIZED PARTS (VOEST CONCERN). pp 32-54 of Materials for High Pressure Vessels of Atomic Power Plants. Moscow; NIIINFORMTYaZhMASh (1973). (In Russian).

Review on power equipment.

This study deals with the problem of selecting common materials for reactor production, experimental reactor parts and separate reactor loops. The most important regions of material usage are indicated, namely in reactor vessels, internal machined parts, volume compensators, steam generators and external shielding. A presentation is given of the main forms of damage to heavy parts (fracture as a result of deformation or excessive deformation, brittle fracture, fatigue fracture and corrosion). Types of steel are described for nuclear reactors that reflect the development of the reactor industry for the next 10 years. (tr-SJR).

2492 IMPORTANCE OF NON-DESTRUCTIVE TESTING IN NUCLEAR INDUSTRY. Balaramamoorthy, K. (Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.). Instrum. India.; 9: No. 3, 12-16(May 1974).

An attempt has been made to highlight the present status and importance of various testing techniques in the nuclear field and the areas in which efforts are being made for further development. The techniques mentioned include (1) ultrasonic tests, (2) eddy currents test and other miscellaneous tests. It has been concluded that different NDT (Non-Destructive Testing) techniques are not competitive but are complementary to one another and that the methods used, the engineering techniques applied, and undoubtedly the NDT required will all have to be developed to support the ever increasing demand for nuclear power. (INIS)

2493 FAILURES IN PRESSURE VESSELS 1966-1971. Cambridge, Eng.; Welding Inst. (1975). 9p.

Abstracts are provided of 35 papers concerning failures in pressure vessels (including papers on the design, inspection, testing and mechanical properties of pressure vessels, and regulations concerning pressure vessels). (UK)

2494 STATUS REVIEW OF ALLOY 800 IN NUCLEAR APPLICATIONS. Pugh, S. F. (United Kingdom Atomic Energy Authority, Harwell, Eng.). J. Br. Nucl. Energy Soc.; 14: No. 3, 221-226(Jul 1975).

A critical summary is presented of the papers given at the British Nuclear Energy Society conference "A status review of Alloy 800", held at Reading, 25-26 September 1974. Aspects considered in order to assess the material for nuclear applications are fabrication, mechanical properties, corrosion, and stress corrosion. The use of Alloy 800 for sodium-cooled fast reactor boiler tubes, for HTR boiler tube and structural material, and for PWR steam generator tubes is also examined. In attempting to optimize composition and heat-treatment a large number of factors must be balanced: the summary is intended as an aid in following the arguments presented in the papers, a list of which is given in an appendix. (UK)

Reactor Fuels

Refer also to abstract 1094.

2495 (AAEC/E-349) EXAMINATION OF THE INFLUENCE OF SPACERS ON BURNOUT IN AN ANNULUS COOLED BY UPFLOW OF FREON-12. Ilic, V. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Apr 1975. 18p. Dep. NTIS (US Sales Only) $4.00.

To evaluate the spacer influence on burnout, tests were carried out in Freon-12 at 1.04 MPa (abs.) test section inlet pressure with an internally heated annulus 2743 mm long by 14.4 mm heater diameter, the outer tube (shroud) having a bore of 22.1 mm. The inner rod (heater) was located centrally to the shroud by spacers and their configuration was changed for each test. Comparison of the results with those obtained with a test section having no spacers indicated that spacers can increase burnout power up to 75 per cent, decrease it, or show no effect at all, depending on the combination of the inlet temperature and mass velocity. If the spacers were streamlined, removed from the upstream portion of the heater or relocated farther upstream from the downstream end of the heater, there was a considerably reduced effect on the test section performance. (auth)

2496 (KFK-2200, pp 149-191) THERMODIFFUSION IN NUCLEAR FUEL OXIDES. Bober, M.; Schumacher, G. Apr 1975. (In German).

In contributions to nuclear engineering.

The significance of thermodiffusion in the changing of fuel during irradiation in the reactor is discussed. The high temperatures, to which the fuel in the center of an oxide fuel rod is subjected, and the steep radial temperature gradient, which arises through the heat transport to the fuel rod cladding, allow thermodiffusion processes to become effective whereby a considerable displacement of the oxygen, fission products and even actinides is possible. A report is given on the present state of investigation of such processes. (GE)

2497 (XN-CC-21(A)(Rev.2)) XPOSE: THE EXXON NUCLEAR REVISED LEOPARD. Skogen, F. B. (Exxon Nuclear Co., Richland, Wash. (USA)). Apr 1975. vp. Exxon Nuclear Co., Richland, WA.

Main differences between XPOSE and LEOPARD codes used to generate fast and thermal neutron spectra and cross sections are presented. Models used for fast and thermal spectrum calculations as well as the depletion calculations considering U-238 chain, U-235 chain, xenon and samarium, fission products and boron-10 are described. A detailed description of the input required to run XPOSE and a description of the output are included. (FS)

2498 NON-DESTRUCTIVE TESTING IN NUCLEAR FUEL FABRICATION. Balaramamoorthy, K.; Chandramouli, V. A.; Kondal Rao, N. (Bhabha Atomic Research Centre, Bombay (India). Atomic Fuels Div.). J. Sci. Ind. Res.; 32: No. 12, 747-750(Dec 1973).

From international symposium on industrial metallurgy; Bangalore, India (9 May 1972).

The various non-destructive tests that are carried out during the fabrication of nuclear fuel and the test procedures are described for both research reactor fuel and power reactor fuel. The application of non-destructive test methods, such as ultrasonic flaw detection, eddy current flaw detection, radiography and leak detection of welds, ultrasonic and air gauging techniques for dimensional control is explained. The use of special jigs and fixtures for dimensional control of power reactor fuel bundles is also mentioned. (auth)

2499 THERMO-MECHANICAL MODELLING OF REACTOR FUEL ELEMENTS. Chen, P. Y. P. Kensington, Australia; Univ. of New South Wales (1974). vp. Librarian, Univ. of New South Wales.

Thesis (Ph.D.).

A linear mathematical analysis is presented of the static temperatures, stresses, and displacements in a canned, cylindrical heat generating element with insulated ends in a channel under conditions of fully developed turbulent flow. With constant physical properties of all components, the formulation and solutions presented are general and exact except for the local elastic response due to self-equilibrating end loads. The thermal analysis is based on the development of an integral equation for axial distribution of each angular harmonic of the can surface temperature to solve the conjugate heat transfer problem. The thermoelastic analysis is based on exact solutions of the displacement equations of elasticity, allowing for uniform surface pressure and shear, and general integral end conditions in terms of appropriate force-displacement relations. A number of developments and extensions of the linear model are also presented. These include linear transient thermal response, temperature dependent material conductivity, linear viscoelasticity, non-linear incremental creep analysis, and the use of synthesis techniques in place of eigen-function expansion to develop the required coolant Green's functions. Numerical solutions of the turbulent flow conjugate heat transfer problem for a flat plate are presented to verify the solution technique, to study the role of axial heat conduction in the solid, and to assess the coolant synthesis approach. (Diss. Abstr. Int., B)

2500 NUCLEAR REACTOR FUEL. Burnett, R. C.; Steemers, T. C. (to United Kingdom Atomic Energy Authority). British Patent 1,390,096. 9 Apr 1975. Filed date 1 Jun 1972. 3p.

Reference is made to carbon coated fuel particles. The fission product retaining properties of carbon coatings has been found to deteriorate prematurely in various ways; one of these involves the migration of carbon preferentially to one side of the coated particle, leaving the opposite side of the particle deficient in carbon, and hence less able to retain fission products and to contain gas pressure. The direction of migration is away from the higher temperature side of the particle. The particles covered by the invention described include a source of carbon at the centre of the particle, the method of formation involving the progressive agglomeration of powdered UO_2 on to a carbon seed. Examples are described. The source of carbon may be spheroidal, with a diameter about one-third that of the fuel particle. In this type of particle weakening of the carbon layer is obviated or at least slowed down. (UK)

2501 EFFECT OF INTERFACE FLUID ON THERMAL CONTACT CONDUCTANCE. Madhusudana, C. V. (New South Wales Univ., Broken Hill, Australia). Int. J. Heat Mass Transfer; 18: No. 7, 989-991(Jul 1975).

Heat transfer experiments were performed on contacts formed by surface combinations of stainless steel/Nilo 36, Nilo 36/UO_2 in vacuum and in air, and of Zircaloy 2/UO_2 in vacuum, argon, and helium, in order to assess the fluid conduction contribution to overall heat transfer. Brief experimental conditions are given. Results reported for data collected during the first loading cycle show that contact conductance improves in the presence of a conducting medium the improvement being significant at low contact pressures; solid spot conductance predominates at high pressures. The fluid conductance contribution to heat transfer across a joint decreases with reduction in fluid pressure, the reduction appearing significant below 100 torr absolute pressure. (UK)

Reactor Control Systems

Refer also to abstracts 691, 692, and 2455.

2502 (INIS-mf-1703, pp 47-63) NUCLEAR REACTOR CONTROL INSTRUMENTATION PRESENT STATE AND DEVELOPMENT AT THE SNIIP (USSR). Matveev, V. V.; Krasheninnikov, I. S.; Polikarpov, V. I. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

Among the directions of nuclear instrumentation construction in the Soviet Research Institute for Equipment Construction in the last ten years, equipment for the control and safety of nuclear power reactors has undergone considerable development. Three periods of development are reviewed. (tr-SJR)

2503 (INIS-mf-1703, pp 288-305) COMPLEX CONTROL SYSTEM FOR A NUCLEAR POWER PLANT WITH RESPECT TO NUCLEAR SAFETY. Emel'yanov, I. Ya.; Gavrilov, P. A. 1974. (In Russian).

From jubilee conference dedicated to the twentieth anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

In nuclear power plant operating experience and prospects of nuclear power engineering. Vol. 2. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow).

At present there are no well-developed theoretical concepts for planning control systems with the use of computers. From general concepts of information theory and functioning of cybernetic system, problems of structure synthesis for mathematically assuring automated control systems for large energy nets are analyzed. (tr-SJR)

2504 APPLICATION OF DIRECT DIGITAL CONTROL TO A HEAVY WATER REACTOR. Siddiqui, Zia; Bajwa, M. Y.; Igleem, J. (Pakistan Atomic Energy Commission, Karachi). Nucleus (Karachi).; 11: No. 3, 3-38(Jul 1974).

2505 PROGRAMM HREX AT THE INSTITUTE OF NUCLEAR RESEARCH. Juricka, V. Nukleon.; No. 2, 51-55(Sep 1974). (In Czech).

A complex research programme is described, abbreviated HREX, whose objective is to study and collect information on the behavior of the spent A-1 reactor fuel elements. A brief review of evaluation methods and technical measures aimed at ensuring the program is given. (auth)

2506 NUCLEAR REACTOR PLANT. Drummond, C. N.; Bybee, R. T.; Mason, F. L.; Worsham, H. J. (to Babcock and Wilcox Co., New York (USA)). Swiss Patent Document 534414/D/. 13 Apr 1973. 4p. (In German).

A description is given of a reactor connected to an external control desk by a channel penetrating into the core of the reactor. The core control system consists of a detector assembly introduced at the control desk and moved longitudinally in the channel to a terminal point in the core. These detectors are capable of testing the physical conditions existing in the core and or sending signals representing these conditions to the control desk. (tr-INIS)

2507 DEVICE FOR THE EMISSION OF SEQUENTIAL SERIES OF PULSES TO DIFFERENT GROUPS OF STEP-WISE MOVABLE CONTROL RODS OF ATOMIC REACTORS. Wavre, A.; Santis, D. C. (to Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Swiss Patent Document 538149/D/. 31 Jul 1973. 9p. (In German).

An apparatus is described for transmitting sequential bank signals from a large number M of element banks containing N elements each, in which each element of each group can be moved step-wise in a cyclic manner. The apparatus contains a signal counter sensitive to the cumulative step-wise displacements of the banks in order to count them. It also has a controllable signal decoder responding to selected and predetermined states of the signal counter in order to produce a selected state signal and also a primary device responding to selected state signals in order to produce sequential bank signals. (tr-INIS)

2508 CONTROLLING NUCLEAR REACTORS. George, B. V.; Ward, D. A. (to British Nuclear Design and Construction Ltd.).

British Patent 1,390,907. 16 Apr 1975. Filed date 23 Dec 1970. 7p.

A method is described for achieving a rapid reduction in the thermal output of the core of a fluid-cooled reactor in which the reactivity of the core is inversely related to its temperature. The method involves inserting neutron absorbers (control rods) into the core to reduce the reactivity and simultaneously reducing the flowrate of coolant through the core to a greater extent than would correspond to the reduction in thermal output rate, thereby allowing the temperature of the core to rise to a value at which the reactivity is further reduced to an extent sufficient to give the desired reduction in thermal output, the temperature achieved being, however, insufficient to initiate reactor trips. (UK)

2509 LOW-SENSITIVITY CONTROL OF NUCLEAR REACTORS. Elmetwally, M. M.; Rao, N. D. (Calgary Univ., Alberta). Electron. Lett.; 11: No. 13, 269-270(26 Jun 1975).

The design of nuclear-reactor controllers with low sensitivity to variations in system operating conditions is formulated. The superiority of the low-sensitivity design over the conventional optimal one is demonstrated by a numerical example. (auth)

2510 STABILITY ANALYSIS OF A NUCLEAR REACTOR CONTROL SYSTEM WITH MULTIPLE TRANSPORT-LAGS AND ASYMMETRICAL NONLINEARITY. Ai, C. H. (Chung-Cheng Inst. of Tech., Taiwan); Han, K. W. IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2103-2112(Oct 1975).

The stability-equation method is applied to the analysis of a nuclear reactor control system with multiple transport-lags and an asymmetrical nonlinearity. The characteristics of limit-cycles can be defined easily, and the effects of adjustable parameters can be realized directly. Based upon the presented analyses, the considered system has asymmetrical oscillation. These are checked by computer simulations. (8 references) (auth)

2511 CONVERSATIONAL DATA ACCESS PROCEDURE FOR CRT OPERATOR CONSOLES. Kishi, S.; Nagaoka, Y.; Serizawa, M. (Atomic Energy Research Lab., Tama, Japan). IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.; NS-22: No. 5, 2113-2117(Oct 1975).

A conversational data access method is proposed in order to avoid the complexity of procedures for data access of CRT operator consoles. The procedure proposed here is composed of three hierarchical steps (tree structural steps), related to the systems of plant components and operational modes. It is concluded from the simulation experiment that the procedure proposed here is superior in many respects to that of the long code entry method. (5 references) (auth)

Nuclear Power Plant Economics

Refer also to abstract 2444.

2512 (KFK-2200, pp 25-49) TARGET FUNCTIONS. Haefele, W. Apr 1975. (In German).

In contributions to nuclear engineering. (Kernforschungszentrum Karlsruhe (F. R. Germany)).

To demonstrate linear programming with cost optimization in mind the report deals with a model for the provision of primary energy with fossil and nuclear fuels as a source. The experiment is extended by trying to come to the same target for non-linear problems, such as emission of harmful substances, environmental influences and risks. (GE)

2513 SCIENCE COUNCIL EMPHASIZES NUCLEAR POWER. McIntyre, H. C. Eng. J. (Montreal); 58: No. 2, 60-63(May 1975).

The Science Council of Canada's report, "Canada's Energy Opportunities" states that Canada should have a long term, national energy policy. The Council advocates nuclear development over other energy sources, and feels that R and D effort should concentrate on the OCR, the thorium fuel cycle, and the refueling of plutonium. It recommends that the Canadian science and technology community should be looking ahead to anticipate the requirements of a totally new energy economy. Some of the other areas into which R and D effort should be directed are coal gasification, oil sands extraction, electrolytically produced hydrogen systems, solar energy, organic waste conversion, as well as various energy storage schemes. (CA)

2514 TOTAL ENERGY INVESTMENT IN NUCLEAR POWER PLANTS. Rombough, C. T. Austin, TX; Univ. of Texas (1975). 164p. University Microfilms Order No. 75-16,727.

Thesis (Ph.D.).

It is demonstrated that energy analysis is a feasible and practical alternative for evaluating the engineering, economic, and environmental aspects of nuclear power systems. All of these characteristics are synthesized into a common energy baseline. The nuclear reactor types which are evaluated are the Pressurized Water Reactor (PWR), Boiling Water Reactor (BWR), Heavy Water Reactor (HWR), High Temperature Gas Cooled Reactor (HTGR), Gas Cooled Fast Reactor (GCFR), and the Liquid Metal Fast Breeder Reactor (LMFBR). It is determined that the total energy investment required for the PWR is 10.0 percent of its energy output, 9.9 percent for the BWR, 10.5 percent for the HWR, 8.8 percent for the HTGR, 7.1 percent for the GCFR, and 7.6 percent for the LMFBR. (Diss. Abstr. Int., B)

Reactor Fuel Cycle Economics

2515 Pu RECYCLE RULE URGENT. Nucl. Ind.; 22: No. 7, 7-10(Jul 1975).

The results of three studies sponsored by the Atomic Industrial Forum are summarized. The studies dealt with legal aspects, economic impact, and safeguards considerations of the NRC provisional plan for plutonium recycle. (DG)

2516 REACTOR FUEL OUTLOOK. Nucl. Ind.; 22: No. 7, 3-5(Jul 1975).

Factors affecting ERDA uranium enrichment requirements are discussed, and the "open season," which provided utilities an opportunity to revise enrichment contracts with ERDA, is described. (DG)

Reactor Licensing and Regulation

2517 (DOCKET-50016-239) ENRICO FERMI ATOMIC POWER PLANT, UNIT 1. June 1974–June 1975. (Power Reactor Development Co., Detroit, Mich. (USA)). 26 Aug 1975. 13p.

Retirement efforts are presented concerning disposal of blanket fuel, nozzle assemblies, fuel transport facilities, pool resin, and miscellaneous contaminated materials and equipment. Data on sodium passivation, primary sodium coolant, and the decay pool are given. Health physics and periodic test activities are described. (FS)

2518 (DOCKET-50155-435) BIG ROCK POINT NUCLEAR PLANT. Semiannual Operations Report No. 22, January–June 1975. (Consumers Power Co., Jackson, Mich. (USA)). 29 Sep 1975. 62p. Dep. NTIS $6.25.

Net electrical power generated was 50,198.2 MWH(e) with the reactor on line 922.6 hrs. Information is presented concerning power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, and abnormal occurrences. (FS)

2519 (DOCKET-50171-196) PEACH BOTTOM ATOMIC POWER STATION, UNIT 1. Semiannual Operations Report No. 72, January–June 1975. (Philadelphia Electric Co., Pa. (USA)). 1975. 18p. Dep. NTIS $4.00.

Defueling of the reactor was completed in June 1975. The fuel will be shipped to Aerojet Nuclear Co. in Idaho for long term storage. The primary coolant and auxiliary helium systems are being shut down. Activities are briefly described concerning health physics and maintenance. (FS)

2520 (DOCKET-50206-452) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. Semiannual Operating Report No. 16, January–June 1975. (Southern California Edison Co., Rosemead (USA)). 20 Aug 1975. 66p. Dep. NTIS $6.50.

Net electrical power generated was 1,356,129 MWH(e) with the reactor on line 3,242.8 hrs. Information is presented concerning power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, abnormal occurrences, and environmental monitoring. (FS)

2521 (DOCKET-50245-532) MILLSTONE NUCLEAR POWER STATION, UNIT 1. Semiannual Operating Report, January–June 1975. (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 1975. 29p. Dep. NTIS $4.50.

Net electrical power generated was 2,373,130 MWH(e) with the reactor on line 3,915 hrs. Information is presented concerning power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, abnormal occurrences, and environmental radiation monitoring. (FS)

2522 (DOCKET-50250-397) TURKEY POINT PLANT, UNITS 3 AND 4. Semiannual Operating Report No. 6, January–June 1975. (Florida Power and Light Co. (USA)). 28 Aug 1975. 161p. (DOCKET-50251-390). Dep. NTIS $11.25.

Net electrical power generated by Unit 3 was 2,676,523 MWH(e) with the plant on line 4,148.8 hrs. Unit 4 generated 1,429,108 MWH(e) and was on line 2,232.0 hrs. Information is presented

concerning power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, abnormal occurrences, and environmental radiation monitoring. (FS)

2523 (DOCKET-50263-516) MONTICELLO NUCLEAR GENERATING PLANT, UNIT 1. Semiannual Operating Report No. 9, January–June 1975. (Northern States Power Co., Minneapolis, Minn. (USA)). 29 Aug 1975. 48p. Dep. NTIS $5.50.

Net electrical power generated was 1,775,704 MWH with the reactor on line 3,583 hrs. Information is presented concerning power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, abnormal occurrences, and radiation environmental monitoring. (FS)

2524 (DOCKET-50277-477) PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3. Semiannual Operating Report, January–June 1975. (Philadelphia Electric Co., Pa. (USA)). 29 Aug 1975. 61p. (DOCKET-50278-381). Dep. NTIS $6.25.

Peach Bottom Unit 2 generated 3,005,350 MWH(e) net electric power and was on line 3,132.48 hrs and Unit 3 generated 2,972,897 MWH(e) and was on line 3,417.97 hours. Information is presented concerning power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, and abnormal occurrences. (FS)

2525 (DOCKET-50309--370) MAINE YANKEE ATOMIC POWER PLANT. Semiannual Operating Report, January--June 1975. (Maine Yankee Atomic Power Co., Westboro, Mass. (USA)). 8 Sep 1975. 70p. Dep. NTIS $6.50.

Net electrical power generated was 1,654,266 MWH(e) with the reactor on line 2,762.7 hrs. Information is presented concerning power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, abnormal occurrences, effluents, and waste disposal. (FS)

2526 (DOCKET-50317-461) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. Semiannual Report No. 2 on Reactor Operation, January–June 1975. (Baltimore Gas and Electric Co., Md. (USA)). 1975. 89p. (DOCKET-50318-232). Dep. NTIS $7.50.

Net electrical power generated by Unit 1 was 1,503,705 MWH with the reactor on line 2,921.4 hrs. Information is presented concerning power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, and abnormal occurrences. Unit 2 is under construction. (FS)

2527 (DOCKET-50548-1) FORT CALHOUN STATION, UNIT 2. License Application, PSAR, General Information. (Omaha Public Power District, Nebr. (USA)). Sep 1975. 64p. Dep. NTIS $6.25.

Application for construction and operating licenses for Calhoun-2 Reactor is presented. Financial data concerning the Omaha Public Power District and the Nebraska Public Power District are included. (DCC)

2528 (DOCKET-50549--1) GREEN COUNTY NUCLEAR POWER PLANT. License Application. (Power Authority of the State of New York (USA)). Jul 1975. 61p. Dep. NTIS $6.25.

The Green County reactor, a PWR to be supplied by Babcock and Wilcox, will be a baseload generating facility planned to provide for mass transit and other public agency electrical needs. The plant is scheduled for completion by 1983 and will have a generating capacity of about 1200 MW(e). (FS)

2529 (FIND-STN-50484) FIND: TYRONE ENERGY PARK, UNIT 1. Williams, W. H. (ed.). (Nuclear Regulatory Commission, Washington, D. C. (USA)). Sep 1975. 20p. Dep. NTIS $4.00.

An index is presented for the docket report material submitted in conjunction with the application for a nuclear power plant construction permit and operating license. The index citations are to the beginnings of major headings, sections, responses, etc., and refer to grid coordinates on microfiche sheets prepared for each docket report. (DCC)

2530 (FIND-STN-50518) FIND: HARTSVILLE NUCLEAR PLANTS, UNITS 1, 2, 3, AND 4. Williams, W. H. (ed.). (Nuclear Regulatory Commission, Washington, D. C. (USA)). Sep 1975. 23p. Dep. NTIS $4.00.

An index is presented for the docket report material submitted in conjunction with the application for a nuclear power plant construction permit and operating license. The index citations are to the beginnings of major headings, sections, responses, etc., and refer to grid coordinates on microfiche sheets prepared for each docket report. (DCC)

2531 (FIND-STN-50532) FIND: C. F. Braun. Standard Turbine Island Design for a BWR Safety Analysis Report. Hendricks, P. L. (ed.). (Nuclear Regulatory Commission, Washington, D. C. (USA)). Nov 1975. 25p. Dep. NTIS $4.00.

An index is presented for microfiche items 1 through 8 for DOCKET-STN-50532 received by U. S. ERDA-TIC through July 31, 1975. The Safety Analysis Report (SAR) is submitted in support of an application by C. F. Braun and Co. for a preliminary design approval for turbine islands for nuclear power plants. Citations refer to items and grid coordinates and are given for major headings or topics of primary interest. (auth)

2532 (NRCI-75/8) NUCLEAR REGULATORY COMMISSION ISSUANCES, AUGUST 1975. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Oct 1975. 205p. TIC $4.00.

Issuances received from the US Nuclear Regulatory Commission, the Atomic Safety and Licensing Appeal Boards, and the Atomic Safety and Licensing Boards are presented. (DCC)

2533 (NUREG/PRDI-75/9) POWER REACTOR DOCKET INFORMATION. (Nuclear Regulatory Commission, Washington, D. C. (USA)). Sep 1975. 75p. TIC $1.85.

Citations and subject indexing to the documentation associated with civilian nuclear power plants are presented. This material is that which is submitted to the Atomic Energy Commission in support of applications for construction and operating licenses. Citations are listed by Docket number in accession number sequence. The Table of Contents is arranged both by Docket number and by power plant name. (JWR)

2534 (RDT-INDEX-10(75)) INDEX OF RDT STANDARDS. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. RSO.

2535 (REG/G-1.70(09-75)(Rev.2)) STANDARD FORMAT AND CONTENT OF SAFETY ANALYSIS REPORTS FOR NUCLEAR POWER PLANTS: LWR EDITION. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Standards Development). Sep 1975. vp. (NUREG-75/094). NUREG.

The purpose of the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (hereinafter "Standard Format") is to indicate the information to be provided in the SAR and to establish a uniform format for presenting the information. Use of this format will help ensure the completeness of the information provided, will assist the Commission's staff and others in locating the information, and will aid in shortening the time needed for the review process. (auth)

2536 EXPERIENCE WITH NUCLEAR POWER PLANT SITING AND SAFETY CRITERIA IN THE FEDERAL REPUBLIC OF GERMANY. Frewer, H. (Kraftwerk Union AG, Erlangen, Ger.). J. Br. Nucl. Energy Soc.; 14: No. 3, 191-197(Jul 1975).

From British Nuclear Energy Society meeting; Risley, Eng. (5 Feb 1975).

The nuclear power program of the Federal Republic of Germany includes ten identical 1300 MW standard PWR units based on the Biblis reactor. Siting problems and licensing procedures are discussed. Owing to the extremely high population density, application to build a plant on the premises of the chemical company BASF led to a large scale research program which included a review of safety requirements and a study of further improvements in engineering safeguards and structural protection measures. Considerations of approval of an application for construction include, primarily, radioactivity release, and effect of external influences such as aircraft crashes, earthquakes, and proximity of explosive materials. Descriptions are given of the emergency feed system, the emergency core cooling system, and testing of the reactor vessel. Finally, comparisons are made between the requirements and procedures of the German Federal Republic and those of the U.S.A. (UK)

2537 THE SAFETY OF LIGHT WATER NUCLEAR POWER STATIONS. Roux, D. Rev. Polytech.; No. 1330, 1287-1293 (25 Oct 1974). (In French).

The fundamental principles involved in the design of nuclear (BWR and PWR) power stations for safety are reviewed; including the "multiple barrier" containment of radioactive products, and the probability of accidents in relation to the risk is estimated. The consequences of nuclear power station accidents are compared with those of accidents in other industrial situations. (INIS)

GENERAL AND MISCELLANEOUS

Civilian Defense

2538 ZASHCHITA NASELENIYA OT RADIOAKTIVNYKH OSADKOV. (Protection of Population From Radioactive Fallout). Sudakov, A. K. Moscow; Atomizdat (1970). 117p. (In Russian).

The sources and nature of radioactive contamination and its effect on the human are considered. The characteristics are given of dosimetric equipment supplied to personnel. Individual and collective methods of protection are discussed together with measures for protection of the population from radioactive substances. Recommendations are given for adaptation of existing places to antiradiation shelters, for activities of people under threat of radioactive contamination and in contaminated places, and for measures for removal of radioactive contamination. (tr-auth)

Information Handling

2539 (AECL-5178, pp 43-48) POPULATION RESEARCH BRANCH. Newcombe, H. B. May 1975.

In Biology and Health Physics Branch. Progress Report, 1 January-31 March 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

Progress is reported on radioinduced tumors in rats; development of information sources for human data on diseases likely to be increased by irradiation; and relationship between maternal irradiation and Down's syndrome. (HLW)

2540 (JINR-P10-9051) PRESENT PROGNOSIS OF THE NUMBER OF RELEVANT DOCUMENTS IN THE IRS OF JINR. Arnaudov, D. D.; Yanev, N. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1975. 19p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A method is described which allows the number of relevant documents in the IRS of JINR to be predicted. The realization of this method is based on the mathematical theory of probability. (3 tables) (auth)

2541 (NVO-153, pp 491-496) INFORMATION AND RESEARCH: AN ESSENTIAL PARTNERSHIP. Oen, C. J. (Oak Ridge National Lab., TN). Jun 1975.

In radioecology of plutonium and other transuranics in desert environments. Nevada Applied Ecology Group progress report as of January 1975. (Energy Research and Development Administration, Las Vegas, Nev. (USA). Nevada Operations Office).

Information support is provided to the Nevada Applied Ecology Group (NAEG) through the Ecological Sciences Information Center (ESIC) at Oak Ridge National Laboratory to offer an effective, easy-to-use link between the individual researcher and the literature relevant to his work. Information within the interest areas defined by NAEG administration is identified and entered into a computerized system that provides rapid, accurate retrieval. The primary topics are the environmental aspects of the transuranic elements. (auth)

2542 NUCLEAR ENERGY. Chillag, J. P. pp 168-189 of Use of Reports Literature. Auger, C. P. (ed.). London; Butterworths (1975).

The sources of information in the nuclear field including the USAEC, UKAEA, IAEA, and their associated publications (NSA, INIS) are described. (UK)

Law

2543 CHANNELLING OF THE LIABILITY IN THE ATOMIC ENERGY LAW FROM THE VIEWPOINT OF THE INSURANCE LAW. Blomeyer, J. G. Berlin; Freie Univ. (1971). 125p. (In German). INIS.

Thesis.

The first of three sections covers the liability provisions under the Atomic Law as against those under the Paris and Brussels Conventions. The second section deals with the insurance aspect and the compulsory government indemnification scheme. In the third section the procedural problems arising from the use of the reservation on article 6 of the Paris Convention are treated and the advantages and disadvantages of an unconditional adoption of the Paris Convention are weighed. An overall survey of the legal consequences resulting from such adoption of the Paris Convention, with or without reservations, shows that the material results of the two alternatives are the same. The basic approach has been fixed already because, if use is made of the reservation, any liability of a third party causing of damage depends on full coverage. The debate about legal channelling thus is reduced to problems without any legal significance. One practical advantage of an unconditional adoption of the Paris Convention would be in the field of claims enforcement. The Convention streamlines the procedure by limiting third party liability to one person and by admitting claims for recourse only in cases of dolus directus. (GE)

Management

2544 (DEU-75-15) VGB PROGRESS REPORT 1972/1973. 1st June 1972 to 31st May 1973. (VGB Technische Vereinigung der Grosskraftwerksbetreiber e.V., Essen (F. R. Germany)). 1973. 218p. (In German). INIS.

Available from ZAED.

The progress report 1972/73 gives a survey on the activities of the major groups of the VGB. The groups work on the different fields of thermal power stations including nuclear power stations, heating, emissions, chemistry in power stations, materials and stresses, construction engineering, and research. (GE)

2545 (KFK-2150) REPORT ON THE ACTIVITIES OF THE INSTITUTES AND DEPARTMENTS OF THE GfK IN 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Feb 1975. 304p. (In German). INIS.

The scientific annual report covers the 1974 business year. On the request of the scientific/technical board and the correspondents, it is composed of contributions of the various organizational groups. These contributions have been supplied by the institutes and departments on their own responsibility. The report consists mainly of information on the work of organizational units as well as their contributions to the scientific program of the GfK. It serves as a decisive factor in the evaluation of individual projects in the F + E program by the supervisory board and as a source of information for the members of the staff who are qualified for comanagement. In order to underline the individual responsibility of the institutes and departments for the contributions, a list of the contributors has been added to each project description for the first time. (GE)

2546 (NP-20560) ANNUAL REPORT, 1974. (CEA, 75-Paris (France)). 1974. 88p. (In French). Dep. NTIS (US Sales Only) $7.50.

This CEA annual report is basically administrative in nature. The first part discusses the missions of the CEA: nuclear materials, military applications, fundamental research, nuclear protection and security, industrial nuclear applications, nonnuclear industrial cooperation, programs of general interest, and international relations. The second part describes the general structure and organization, financing, and personnel of the CEA. (RWR)

2547 (NP-20561) ANNUAL REPORT ON SCIENTIFIC ACTIVITIES AND TECHNIQUES, 1974. (CEA, 75-Paris (France)). 1974. 223p. (In French). Dep. NTIS (US Sales Only) $14.25.

This volume, an adjunct to the CEA annual report, describes the principal scientific achievements and techniques of the year, grouped by mission. This publication is especially suited for specialized journalists, scientists, and engineers who desire either a summary of CEA activities or information on a particular point at a greater depth than is possible in an annual report. The chapters are titled as follows: production of nuclear materials for industry, military applications, fundamental research, nuclear protection and security, industrial nuclear applications, nonnuclear industrial cooperation, programs of general interest, and common technical means for research. An organization chart is given in the appendix. (RWR)

2548 (SAND-74-0082) SANDIA LABORATORIES TECHNICAL CAPABILITIES. Auxiliary Capabilities: Environmental Health Information Science. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1975. Contract AT(29-1)-789. 24p. Dep. NTIS $4.00.

Sandia Laboratories is an engineering laboratory in which research, development, testing, and evaluation capabilities are integrated by program management for the generation of advanced designs. In fulfilling its primary responsibility to ERDA, Sandia Laboratories has acquired extensive research and development capabilities. The purpose of this series of documents is to catalog the many technical capabilities of the Laboratories. After the listing of capabilities, supporting information is provided in the form of highlights, which show applications. This document deals with auxiliary capabilities, in particular, environmental health and information science. (11 figures, 1 table) (RWR)

2549 (STI/DOC-10/162) NUCLEAR SCIENCE TEACHING III. Report of a Panel Held in Athens, 7-11 May 1973. (International Atomic Energy Agency, Vienna (Austria)). 1975. 34p. Unipub, New York $3.00.

The IAEA and UNESCO have jointly convened Panels of Experts to assess the present status of teaching of topics related to nuclear science at the secondary school and early university levels (including teacher training) and to suggest appropriate means by which these topics might be incorporated into the science curricula. This report is a record of the contributions of the third Panel of Experts, held at Athens from 7 to 11 May 1973. The objective was similar to that of earlier meetings in that the central theme was the promotion of nuclear science teaching, but the fields emphasized were biological and agricultural sciences. It is hoped that this report will be of use to all involved in revitalizing and modernizing the biological and agricultural science curricula at the high school and early university levels and those working to ensure that society knows about and benefits from the role that nuclear science can play in agriculture and biology. (1 figure) (RWR)

2550 (TID/SNA-3085) FINAL 1963 SEMI-ANNUAL RELIABILITY REPORT FOR PRODUCTION MODEL SOLID ROCKET MOTORS. Williamson, F. R. (Aerojet-General Corp., Sacramento, Calif. (USA)). 15 Feb 1964. 69p. Dep. NTIS $5.50.

Declassified 24 Sep 1975.

The Solid Rocket Plant management is presented a continuing overall assessment of the observed reliability of production model solid rocket motors, based upon field and in-plant firings. The field firing data covers usage from first deliveries through the calendar year of 1963. The inplant acceptance/assurance firing test data provides detailed information for 1963 and reliability percentages only for 1962 and 1961. (auth)

Mathematics and Computers

Refer also to abstracts 583, 622, 673, 819, and 1052.

2551 (DP-MS-75-83) AUTOMATED DATA SYSTEM FOR EMERGENCY METEOROLOGICAL RESPONSE. Kern, C. D. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 15p. (CONF-750967-3). Dep. NTIS $4.00.

From 3rd ERDA environmental protection conference; Chicago, Illinois, USA (23 Sep 1975).

The Savannah River Plant (SRP) releases small amounts of radioactive nuclides to the atmosphere as a consequence of the production of radioisotopes. The potential for larger accidental releases to the atmosphere also exists, although the probability for most accidents is low. To provide for emergency meteorological response to accidental releases and to conduct research on the transport and diffusion of radioactive nuclides in the routine releases, a series of high-quality meteorological sensors have been located on towers in and about SRP. These towers are equipped with instrumentation to detect and record temperature and wind turbulence. Signals from the meterological sensors are brought by land-line to the SRL Weather Center-Analysis Laboratory (WC-AL). At the WC-AL, a Weather Information and Display (WIND) system has been installed. The WIND system consists of a minicomputer with graphical displays in the WC-AL and also in the emergency operating center (EOC) of SRP. In addition, data are available to the system from standard weather teletype services, which provide both routine surface weather observations and routine upper air wind and temperature observations for the southeastern United States. Should there be an accidental release to the atmosphere, available recorded data and computer codes would allow the calculation and display of the location, time, and downwind concentration of the atmospheric release. These data are made available to decision makers in near real-time to permit rapid decisive action to limit the consequences of such accidental releases. (auth)

2552 (NP-20569) ANALYSIS AND SYNTHESIS OF DIGITAL CIRCUITS FOR A DEDICATED COMPUTER. Rosales, E. E. M. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Ingenieria Mecanica y Electrica). 1975. 239p. (In Spanish). Dep. NTIS (US Sales Only) $15.00.

Thesis.

Theoretical studies for the development of logic and sequential circuits to be used in a computer for plasma diagnosis and control are presented. The computer must be capable of processing automatically data from electrostatic probes and calculating on-line the plasma density and off-line the plasma density and electron temperature. Formal methods of analysis and synthesis of combined and sequential circuits are described. The results of experimental testing of the circuits developed are given. As the analysis of sequential circuits requires excessive manual computation, a digital computer program was written for the necessary calculations. It is given in an appendix. (JSR)

2553 (WAPD-TM-1209) SOLUTION OF LINEAR EQUATIONS RESULTING FROM FINITE ELEMENT DISCRETIZATIONS OF MULTIDIMENSIONAL BOUNDARY VALUE PROBLEMS. Hageman, L. A. (Bettis Atomic Power Lab., West Mifflin, Pa. (USA)). Aug 1975. Contract E(36-1)-GEN-14. 61p. Dep. NTIS $6.25.

Direct rather than iterative methods are usually used to solve the large system of equations resulting from finite element discretizations of multidimensional boundary value problems. This preference for the direct method of solution, while not without justification, has progressed to the point where iterative solution methods are considered as passe to some. This paper summarizes the initial results of a study to determine if, indeed, iterative methods are no longer competitive with direct solution methods. It is concluded that iterative methods continue to possess potential as a practical tool and are probably necessary if detailed three-dimensional problems are to be solved in the future. (11 figures, 13 tables) (auth)

2554 HYDRODYNAMIC FLUCTUATIONS, BROKEN SYMMETRY, AND CORRELATION FUNCTIONS. Forster, D. Frontiers in Physics: a Lecture Note and Reprint Series. Reading, MA; W. A. Benjamin, Inc. (1975). 356p. $19.50.

The coverage includes the simple example of spin diffusion, formal properties of correlation functions, the normal fluid, the memory function formalism, Brownian motion, broken symmetry, hydrodynamic spin waves in ferromagnets, and antiferromagnets, superfluids, nematic liquid crystals, and superconductors. (JFP)

Miscellaneous

2555 (LA-5999-MS) ANAKTUVUK PASS, ALASKA VILLAGE CENSUS. Hanson, W. C. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. Contract W-7405-ENG-36. 37p. Dep. NTIS $4.00.

This census represents an updating of similar censuses conducted during November 1969, issued as AEC Research and Development Report BNWL-1242, and September 1972, issued as USAEC Report COO-2122-11. Over the years 1962-1975 during which the studies have been conducted, several records have been consulted for the information contained herein. Most important were those of the late Homer Mekiana, who maintained the census as a part of his several duties in the village until his death in December 1968. His records were updated in 1962 by Mrs. Susan Lockwood, State schoolteacher in the village at that time. Since 1962, I have kept the census current with the help of several village residents, especially Mr. Bob Ahgook, the current medical aide. These records are not final, because the composition of the village constantly changes; however, the information is as current and as accurate as possible. They are presented here for the use of several scientists and laymen who recognize the unique qualities of the Anaktuvuk Pass people and wish to know them better. (auth)

2556 PEACEFUL USES OF NON-PEACEFUL ATOMS. Krishna Dutt (Rajasthan State Road Transport, Zalawad (India)). Vaigyanik.; 6: No. 2, 22-25(Apr 1974). (In Hindi).

Some of the applications of radioisotopes and radiations are briefly described such as radiation treatment; radiodiagnosis; radiometric uses; mineral exploration; radiosterilization; and dating. (INIS)

Appendix 1

SCOPE AND SECTION ARRANGEMENT OF NUCLEAR SCIENCE ABSTRACTS

Introduction

This publication defines the subject scope and arrangement of the literature in *Nuclear Science Abstracts (NSA)*. Broadly stated, the subject scope of *NSA* includes all of nuclear science and technology defined as follows:

> Nuclear science is the study of the production, properties, and phenomena of atomic nuclei, subatomic particles, and nuclear radiation.
>
> Nuclear technology is the application of nuclear science to other sciences and engineering, and conversely, the application of other sciences and engineering to the problems of nuclear science.

Part 1 identifies the major fields of nuclear science and technology into which *NSA* is divided. Subdivisions are listed under each field. Each subdivision is followed by statements of specific subject interest. These statements have been prepared to show the exact range and limits of subject interest for selecting literature abstracted and indexed in *NSA*.

Part 2 identifies the extent of interest in the chemical elements.

An index to Part 1 begins on page 23.

NSA covers reports, journals, books, patents, reviews, theses, conferences, and other similar literature. Selection is based on subject content; nothing is excluded solely on the basis of form, origin, or language. Some of the general practices followed in selecting literature for *NSA* are as follows:

1. Popular type articles are not included.
2. Textbooks below the graduate level are not included.
3. Theses below the doctoral level are not included.
4. Patents that have been filed in several countries are included only once.
5. Material existing only as abstracts or short summaries is not included except for papers summarized in the *Transactions of the American Nuclear Society*.
6. Material initially published in a language other than English may be included both when an item is published in the original language and when an item appears in an English language translation.
7. Related groups of engineering drawings and specifications are abstracted and indexed in *NSA* when they become publicly available.
8. As a general practice, material more than two years old is not included in *NSA*.

All journals scanned regularly are listed annually in Issue No. 1 of odd numbered volumes. New additions are listed in issue 1 of even numbered volumes.

Part 1

SCOPE AND ARRANGEMENT OF NSA
(Numbers in parenthesis are for retrieval purposes)

CHEMISTRY (40.000)

Analytical and Separations Chemistry (40.100)

[Analytical chemistry of isotopes, transactinides, actinides, lanthanides, Be, Cs, I, Kr, Mo, Nb, Pm, Rn, Ra, Ru, Sc, Sr, Ta, Tc, Te, Xe, Y, Zr, or any element or compound if the application is directly associated with nuclear technology. Analyses to determine reactor fuel burnup; burnup calculations are included under REACTOR TECHNOLOGY. Arrangement is according to analytical procedure. Information relative to analytical methods is included as indicated.]

Activation and Nuclear Reaction Procedures (40.110)

The subject in general or descriptions of the method.

Chemical and Spectral Procedures (40.120)

Radiometric and Radiochemical Procedures (40.130)

Nuclear radiometric or radiochemical procedure, including properties of radioisotopes as sources in x-ray analyses. Routine tracer studies are excluded.

Separation Procedures (40.140)

Separation procedures for transactinides, actinides, lanthanides, Be, Cs, I, Kr, Mo, Nb, Pm, Rn, Ra, Ru, Sc, Sr, Ta, Tc, Te, Xe, Y, Zr, and any material of interest in nuclear technology except the procedures covered elsewhere, e.g., under Activation Procedures, Reactor Fuel Reprocessing, and Radioactive Waste Treatment.

Inorganic, Organic, and Physical Chemistry (40.200)

Chemical and Physicochemical Properties (40.210)

Chemical and physicochemical properties of nonradioactive elements, compounds, or mixtures directly associated with nuclear technology. Also includes the preparation of radioprotective compounds.

Isotope Effects (40.220)

Isotope effects on nonnuclear chemical and physical properties. Isotope effects are excluded when used only as a tool in the analysis of reaction mechanisms or in structure studies.

Isotope Exchange and Isotope Separation (40.230)

Isotope exchange if the exchange is of primary concern or the exchange mechanism is used in isotope separation.

Chemical and physicochemical isotope separations are included here; but industrial scale processes such as gaseous diffusion and centrifugation are included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY. Radioisotope production is included under Radiochemistry and Nuclear Chemistry.

Feed Materials Processing (40.240)

Chemical processing of ores for recovery of uranium or thorium, including all extraction, conversion, or reduction steps. Also includes chemical engineering of plants for such processing, but site surveys and environmental impact are included under ENVIRONMENTAL AND EARTH SCIENCES.

Radiation Chemistry (40.300)

[The radiations considered here include accelerated ions, gamma radiation, x radiation, bremsstrahlung, neutrons, protons, alpha particles, beta particles, deuterons, and other subatomic particles. Ultraviolet, infrared, and visible radiations are not included.]

Radiation effects on the chemical and physicochemical properties of any element, compound, or mixture. General papers on solvated electrons and hydroxyl radicals are also included. Radiation effects on the biological activity of biochemicals in vitro or in vivo and all information on radiation effects on biochemicals in living organisms are included under LIFE SCIENCES. Radiation effects on metallurgical or solid state properties are included under MATERIALS or PHYSICS (SOLID STATE).

Radiochemistry and Nuclear Chemistry (40.400)

Radiochemistry and nuclear chemistry are included without restrictions except for tracer applications and labeled compound preparation, which are included only if there is a contribution to the technology. Include those items that detail the technology, but exclude those in which no change in methodology is indicated.

Hot-Atom Chemistry (40.410)

Any aspect, including recoil production and reactions.

Properties of Radioactive Materials (40.420)

Chemical and physicochemical properties of radioactive elements or materials, including the stability of labeled compounds and chemical decontamination of surfaces or work areas. Decontamination of reactor vessels following accidents is included under REACTOR TECHNOLOGY.

Radioactive Waste Treatment (40.430)

Radioactive waste processing for concentration, decontamination, or fission product recovery.

Waste disposal monitoring is included under ENVIRONMENTAL AND EARTH SCIENCES; waste disposal is included under NUCLEAR MATERIALS AND WASTE MANAGEMENT.

Radioisotope Production (40.440)

Radioisotope production processes involving chemical separations. Development and uses of radioisotope radiation sources are included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

Reactor Fuel Reprocessing (40.450)

Reactor fuel processing, including analytical control, chemical separations, solvent studies, and plant and process design, performance, and operation. Environmental monitoring and impact are included under ENVIRONMENTAL AND EARTH SCIENCES.

CONTROLLED THERMONUCLEAR RESEARCH (70.000)

Plasma and thermonuclear physics, except solid-state plasma, arranged as follows:

Confinement and Heating (70.100)

Diagnostics (70.200)

Kinetics (General) (70.300)

Kinetics (Experimental) (70.400)

Kinetics (Theoretical) (70.500)

Production (70.600)

Stability (70.700)

Thermonuclear Engineering and Equipment (70.800)

Wave Phenomena (70.900)

ENGINEERING (42.000)

Energy Conversion (42.100)

Equipment and methods for the direct conversion of nuclear energy from radioisotopes or fission products into electric energy, e.g., beta-voltaic cells, thermoelectric generators, thermionic converters, cardiac pacemakers, etc. Information on the use of reactors as heat sources for electric energy generation is categorized under REACTOR TECHNOLOGY AND REGULATION. Information on the fabrication, performance testing, and use of radioisotope heat sources is categorized under ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

Facilities and Equipment (42.200)

Design, construction, operation, and applied mechanics studies (stress, strain, motion, vibration, elasticity, deformation, etc.) of nuclear facilities and equipment including components of such facilities and equipment, e.g., irradiation plants, pilot plants, laboratories, etc. Only those facilities and equipment are included here for which a more appropriate category has not been provided. In general, information on facilities and equipment is included under categories more closely related to the purpose of the facility or equipment, e.g., CHEMISTRY, PARTICLE ACCELERATORS, REACTOR TECHNOLOGY AND REGULATION. Remote handling equipment is included under NUCLEAR MATERIALS AND WASTE MANAGEMENT.

Lasers (42.210)

Laser research and development information (not applications). Applications of lasers in isotope separation are included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY and CHEMISTRY. Applications of lasers in fusion plasma production and heating are included under CONTROLLED THERMONUCLEAR RESEARCH.

Cryogenic and Superconducting Equipment and Devices (42.220)

Design, fabrication, performance, and testing of superconducting equipment and devices, e.g., superconducting cables, magnets, generators, etc., or equipment and devices using superconductors or superconducting junctions as a component, e.g., superconducting quantum interference devices (SQUIDS), Josephson junctions, etc. Cryogenic equipment and devices are also included when such equipment and devices are used in applications of superconductivity. Applications of superconductivity in accelerators and fusion reactors are included under PARTICLE ACCELERATORS and CONTROLLED THERMONUCLEAR RESEARCH, respectively. Information on the theory of superfluidity and superconductivity is included under PHYSICS (LOW-TEMPERATURE). Information on superconducting materials is included under MATERIALS.

Heat Transfer and Fluid Flow (42.300)

Heat transfer and fluid flow if nucleate boiling, boiling burnout, critical heat flux, two-phase flow, flow in rod bundles, or liquid metals are considered. Heat transfer or fluid flow applied in nuclear technology is included under sections for the application.

Materials Testing (42.400)

Destructive or nondestructive materials testing if a direct application to nuclear technology is indicated and if categorization on the basis of application would be less appropriate. In general, information on component testing is included under categories more closely related to the component, e.g., information on reactor fuel element testing is included under REACTOR TECHNOLOGY.

The use of radioisotopes and radiation sources in radiographic or radiometric testing is included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

Nuclear Explosions (42.500)

Detection of nuclear explosions and civil uses of nuclear explosions, including simulations using non-nuclear explosives.

Protective Structures and Equipment (42.600)

Structures and equipment designed primarily for equipment and personnel protection, e.g., blast and fallout shelters, shielding (except for accelerator and reactor shielding), clean rooms, air filtration systems, fire protection systems, masks, and special clothing. The fabrication of bulk shielding is

included under MATERIALS, shielding calculations are included under PHYSICS (RADIATION AND SHIELDING), and remote-handling equipment is included under NUCLEAR MATERIALS AND WASTE MANAGEMENT.

Safety Engineering (42.700)

Safety at nuclear facilities if no more appropriate category is provided. In general, safety engineering information is included under categories for specific activities or facilities, e.g., Nuclear Explosions or REACTOR TECHNOLOGY.

Vacuum Engineering (42.800)

Ultrahigh (10^{-9} torr or greater) vacuum systems and equipment if no nuclear application is indicated. Applied vacuum engineering is included under categories for the applications, e.g., PARTICLE ACCELERATORS.

ENVIRONMENTAL AND EARTH SCIENCES (44.000)

Minerals and Ores (44.100)

Identification, properties, prospecting, mining, and estimated reserves of thorium and uranium minerals and ores (including equipment). Chemical processing of ores is included under CHEMISTRY.

Radioactive Effluents (44.200)

Concentration or levels of radioactive materials discharged to the natural environment (atmosphere, soil, and waters) under accident or normal operating conditions at nuclear facilities.

Radioactivity Monitoring and Transport (44.300)

Monitoring and/or transport and distribution of radioactive materials (including natural radioactivity) in or through the atmosphere, soil, or waters of the earth. Also includes monitoring and radiation hazards presented by radioactive materials in ecosystems or food cycles. Instrumentation for monitoring radioactivity is included under INSTRUMENTATION.

Radiometric Techniques (44.400)

Use of radioisotopes or radiation sources in investigations of the environment or the earth, e.g., soil and water movement, isotopic methods of geochronology, etc., if the technique is of primary concern or is presented as an advancement of the technology. Instrument design is included under INSTRUMENTATION.

Site Surveys (44.500)

Evaluation and selection of sites for nuclear installations such as fuel fabrication plants, radiochemical processing plants, and nuclear explosions. Seismological and background radiation surveys are included. Ecological studies of sites for nuclear facilities and sites for radiological research are also included. Nuclear power plant siting is included under REACTOR TECHNOLOGY.

Thermal Effluents (44.600)

Characteristics, quantities, and effects of thermal discharges to the atmosphere, soil, or waters of the earth from chemical plants, both fossil- and nuclear-fueled power plants, or any other facility with thermal discharges of the same order of magnitude.

Chemical Effluents (44.700)

Characteristics, quantities and effects of nonradioactive chemical discharges to the atmosphere, soil, or waters of the earth from nuclear facilities such as reactors, gaseous diffusion plants, fuel reprocessing plants, etc. Chemical effluents considered in comparative studies of energy production methods are also included.

INSTRUMENTATION (46.000)

Radiation Detection Instruments (46.100)

Arrangement is as follows:

- General Detectors and Monitors
- Radiation Dosimeters
- Nuclear Spectroscopic Instrumentation (Includes Moessbauer spectrometers)
- High-Energy Physics Instrumentation

Radiometric Instruments (46.200)

Any instrument employing a radiation source and/or radiation detector in its operation.

Radiation Effects on Instrument Components, Instruments, or Electronic Systems (46.300)

Miscellaneous Instruments (46.400)

Limited to instruments, instrument components, or instrumentation systems for application in nuclear technology.

ISOTOPE AND RADIATION SOURCE TECHNOLOGY (47.000)

Isotope Separation (Industrial) (47.100)

Industrial processes for heavy water production, uranium enrichment, or other isotope separation.

Isotopic Power Sources (47.200)

Use of radioisotopes (fission products) as sources of electric, propulsive, or thermal energy.

Radiation Sources (47.300)

Design or fabrication of radiation sources, including neutron sources, but not accelerators or reactors. Use of radiation sources in industrial processes such as food processing, sterilization of medical supplies, polymer production, etc. Basic radiation effects are included under CHEMISTRY or LIFE SCIENCES, but information on radiation effects that influence product acceptability or marketability, such as color or taste, is included here.

LIFE SCIENCES (48.000)

[For this section the term RADIATION is defined as nuclear particles, accelerated electrons and ions, and γ and x radiations. Information on uv effects is included *only* if microorganisms, cells, or biochemicals are the subjects of study. Laser radiation, magnetic fields, microwaves, and sunlight are excluded. The concept of RADIATION EFFECTS includes the effect itself, radiomimetic effects, and any information relating to the effect, e.g., information on assessment, prevention, alteration, transmission, reversal, recovery, etc., and information on the determination or influence of experimental variables such as dose, dose rate, LET, etc. This includes modification of radiation effects by radioprotective or effect-enhancing substances and studies on these substances to establish their independent effects. Theoretical aspects of dose determination or measurement in tissue equivalent materials or phantoms are included under PHYSICS (RADIATION AND SHIELDING).]

Radiation Effects on Biochemicals (48.100)

Effects on biochemicals in living organisms and on their biological activity; information on other effects on biochemicals outside living organisms is included under CHEMISTRY. Also includes the preparation of materials for irradiation and irradiation procedures. The preparation of the radiation sources is included under CHEMISTRY or ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

Radiation Effects on Cells (48.200)

Effects of radiation from external or internal sources on cells in vitro, including cells in cultures; effects on in vivo cells are included in other LIFE SCIENCES categories for entire organisms. Also includes information on the preparation of materials for irradiation and irradiation procedures. The preparation of the radiation sources is included under CHEMISTRY or ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

Radiation Effects on Microorganisms (48.300)

Effects on microorganisms, including bacteria, protozoa, unicellular algae, fungi, and yeasts. Uses of radiation in industrial processes for the radiopreservation of food, radiosterilization of medical supplies, radiation preparation of vaccines, etc., are included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY unless effects on specific organisms are considered.

Radiation Effects on Plants (48.400)

Effects on plants (including multicellular algae and in vivo studies on plant cells), of external-source radiations including the preparation of materials for irradiation and irradiation procedures. The preparation of the radiation sources is included under CHEMISTRY or ISOTOPE AND RADIATION SOURCE TECHNOLOGY. Industrial processes for radiopreservation or disinfestation of foods is under ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

Radiation Effects on Animals (48.500)

Man (48.510)

Effects of external-source or implanted-source radiations on man or on human tissues or cells in vivo. Therapeutic irradiation is included *only* if there is significant information on the effects on normal tissues, if evaluations are made for new radiation sources, e.g., pion beams, or if a contribution is made to the technology. Include those items that detail the technology, but exclude those in which no change in methodology is indicated.

Vertebrates (48.520)

Effects of external-source or implanted-source radiations on vertebrates or on vertebrate tissues or cells in vivo, including the preparation of animals for irradiation and irradiation procedures. The preparation of radiation sources is included under CHEMISTRY or ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

Invertebrates (48.530)

Effects on invertebrates or on invertebrate tissues or cells in vivo, including the preparation of the organism for irradiation and irradiation procedures. The preparation of radiation sources is included under CHEMISTRY or ISOTOPE AND RADIATION SOURCE TECHNOLOGY. Industrial scale processes for pest control and crop disinfestation are included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY unless there is significant information on the effects of radiation on specific organisms.

Radionuclide Effects (Internal Source) (48.600)

[Absorbed or incorporated radioactive materials, not implanted sources, in any in vivo studies.] Internal source evaluation and effects, including experimental procedures, but not the preparation of labeled compounds for administration.

Nuclide Kinetics and Toxicology (48.700)

Kinetics and toxicology of deuterium and radionuclides in or on living organisms. Also includes contamination and decontamination, both internal and external, of living organisms. Levels and movement of radionuclides through man's environment are included under ENVIRONMENTAL AND EARTH SCIENCES.

New Tracer Techniques (48.800)

Use of isotope tracers in LIFE SCIENCES research, e.g., animal husbandry, disease and pest control, ecology, medicine, if a contribution is made to the evaluation and technology of tracer usage. Include those items that detail the technology, but exclude those in which no change in methodology or application is indicated. Also includes extensive bibliographies or reviews.

MATERIALS (50.000)

Corrosion, erosion, surface phenomena, fabrication, phase studies, and properties (including physical, mechanical, electrical, and solid-state) are included with the limitations indicated in the arrangement below.

Radiation damage in or radiation effects on any material are included with the following exceptions:

Radiation effects on biological materials are included under LIFE SCIENCES.

Radiation effects on chemical or physicochemical properties are included under CHEMISTRY.

Ceramics and Cermets (50.100)

Coverage includes the borides, carbides, hydrides, nitrides, and oxides of those elements in Part 2 in which a metallurgy interest is indicated. Any studies of other ceramic or cermet materials supported by a nuclear organization or agency and studies of such materials at cryogenic temperatures are also covered.

Metals and Alloys (50.200)

Coverage includes those elements in Part 2 in which a metallurgy interest is indicated. Also covered are any metals or alloys studied at cryogenic temperatures and superconducting metals. Any other metals studies, such as steels, supported by a nuclear organization or agency are covered.

Other Materials (50.300)

Largely limited to materials applied or specifically for application in nuclear technology, e.g., carbon, graphite, concretes, plastics; but also includes any nonmetallic superconducting material or material, such as insulators, applied at cryogenic temperatures.

NUCLEAR MATERIALS AND WASTE MANAGEMENT (52.000)

Equipment, methods, standards, and systems, for safeguarding and management of materials of nuclear interest, e.g., fissionable materials, radioactive materials, radioactive wastes, or materials of special interest such as heavy water. The arrangement is as follows:

Accountability and Safeguards (52.100)

Research and development on equipment, methods, and systems to guard against the diversion of nuclear materials from uses permitted by law or treaty.

Disposal and Storage (52.200)

Studies, including economic, related to methods for the management, disposal, or storage of radioactive wastes, e.g., land burial, sea disposal, tank storage, or salt mine storage. Geological, hydrological, and seismological studies related to waste disposal are included. Monitoring, transport, and distribution of radioactive materials in the atmosphere, soil, and waters of the Earth are included under ENVIRONMENTAL AND EARTH SCIENCES.

Handling Equipment and Procedures (52.300)

Design, construction, and operation of equipment and facilities for handling radioactive materials, e.g., remote-handling equipment, glove boxes, and hot cells. Non-reactor criticality studies are included.

Transportation (52.400)

Regulatory and administrative aspects of radioactive materials shipping. Design, development, evaluation, and testing of radioactive materials shipping containers.

Radioactive waste processing is included under CHEMISTRY.

PARTICLE ACCELERATORS (54.000)

Particle, ion, atom, or molecule accelerators. The arrangement is as follows:

Design, Development, and Operation (54.100)

Auxiliaries and Components (54.200)

Ion Sources and Injection and Extraction Systems (54.300)

Ion Optics and Field Calculations (54.400)

Storage Rings (54.500)

Experimental Facilities (Includes Radiation Targets) (54.600)

PHYSICS (ASTROPHYSICS AND COSMOLOGY) (56.000)

Cosmic Radiation (56.100)

Cosmic radiation, including exposure ages and induced radioactivity of extraterrestrial material, e.g., meteorites and lunar material. Cosmic-ray interactions with the atmosphere and with the geomagnetic field are included under PHYSICS (ATMOSPHERIC).

Stars (56.200)

Composition, evolution, physical conditions, and nucleogenesis of stars; including neutron stars, black holes, and other starlike objects. Celestial mechanics and routine astronomical observations, e.g., sky surveys, are excluded.

Quasi-Stellar, Radio, and X-Ray Sources (56.300)

Theory, detailed studies, and location of such objects.

Solar Phenomena (56.400)

Sunspots and solar prominences, disturbances, wind, flares, radio bursts, magnetic fields, structure, and spectra. Solar wind interactions with the atmosphere or geomagnetic field are included under PHYSICS (ATMOSPHERIC).

Galaxies (56.500)

Formation, structure, and evolution of galaxies, characteristics of interstellar medium, and identification of molecular species in space.

Cosmology (56.600)

Structure and evolution of the Universe, gravitational collapse and detection of gravitational waves, and tests of general relativity. Gravitational wave detectors are included under INSTRUMENTATION. General relativity theory and field theories of gravitation are included under PHYSICS (HIGH-ENERGY).

Planetary Phenomena (56.700)

Interplanetary magnetic fields, radio emissions from planets, natural radioactivity of extraterrestrial materials,

formation and evolution of planetary systems (including the solar system), and radiation belts. Van Allen belts are included under PHYSICS (ATMOSPHERIC).

PHYSICS (ATMOSPHERIC) (58.000)

Auroral and Ionospheric Phenomena (58.100)

Associated particle kinetics only.

Effects of Nuclear Detonations (58.200)

Atmospheric effects only.

Magnetospheric Phenomena (58.300)

PHYSICS (ATOMIC AND MOLECULAR) (60.000)

Beams and Their Reactions (60.100)

Methods of production and techniques of using atomic, electron, ion, and molecular beams.

Electron and ion sources not developed for specific applications.

Reactions of beams with materials in bulk (e.g., scattering by surfaces, secondary emission, sputtering yields, etc.)

Atomic and Molecular Properties (60.200)

Atomic properties (experimental and theoretical studies) of helium, hydrogen (also deuterium and tritium), the lanthanides, scandium, technetium, yttrium, and elements having $Z > 84$.

Molecular properties of deuterium, helium (He_2, He_3, etc.), helium hydrides, hydrogen (H_2, H_2^+, H_3^+, etc.), tritium, and compounds of technetium and of elements having $Z > 84$.

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules (60.300)

Properties of positronium, muonium, and muonic and mesic (π, K, etc.) atoms and molecules. Exotic atoms (involving antiprotons, hyperons, etc.) are included under PHYSICS (HIGH-ENERGY).

Basic mechanisms of positron annihilation, but not studies using positron annihilation as a tool.

Collision Phenomena (60.400)

Experimental and theoretical studies of elastic scattering, charge exchange (electron capture, electron loss, and electron attachment or detachment), excitation (deexcitation, excitation transfer), ionization, or dissociation in collisions of the following type: electron–ion, electron–atom, electron–molecule, ion–ion, ion–atom, ion–molecule, atom–atom, and atom–molecule.

Rearrangement collisions ($A + BC \rightarrow AB + C$), chemical exchange, and collisions in confined gases when no external beam is involved are excluded.

Atomic Theory (60.500)

Theory of atomic structure and properties when generally applicable. For theoretical studies of specific elements, see first statement under Atomic and Molecular Properties.

PHYSICS (ELECTROFLUID AND MAGNETOFLUID) (62.000)

Electrofluid and magnetofluid mechanics only.

PHYSICS (HIGH-ENERGY) (64.000)

Particle Interactions and Properties (Experimental) (64.100)

Experimental studies on the electromagnetic, weak, and strong interactions; on properties of particles and radiation quanta; on hypernuclei and hyperonic or antiprotonic atoms; and on particle or radiation quanta reactions with nuclei above the pion production threshold (~400 MeV). Information on the energy range below 400 MeV is included under PHYSICS (NUCLEAR).

Particle Interactions and Properties (Theoretical) (64.200)

Theoretical studies on the electromagnetic, weak, and strong interactions; on properties of particles and radiation quanta; on hypernuclei and hyperonic or antiprotonic atoms; and on particle or radiation quanta reactions with nuclei above the pion production threshold (~400 MeV). Information on the energy range below 400 MeV is included under PHYSICS (NUCLEAR).

Particle Invariance Principles and Symmetries (64.300)

Space-time symmetries and internal symmetries of particles and the applications of these symmetries to the electromagnetic, weak, and strong interactions.

Scattering Theory (64.500)

General scattering theory only; the application of scattering theory to specific interactions or types of particles is included under sections according to type of interaction.

NOTE: Category 64.400 (Field Theories) is discontinued. This subject area is now included in 76.000 PHYSICS (THEORETICAL).

PHYSICS (LOW-TEMPERATURE) (66.000)

Superfluidity (66.100)

Theory of superfluidity and studies on liquid helium as a superfluid.

Superconductivity (66.200)

Theory of superconductivity and superconducting phenomena.

Properties of specific superconducting materials are included under MATERIALS. Cryogenic equipment and superconducting magnets and devices are included under

ENGINEERING, except where categorization by application, e.g., PARTICLE ACCELERATORS, is more appropriate.

PHYSICS (NUCLEAR) (68.000)

The arrangement is as follows:

Neutron Interactions with Matter (68.100)

Neutron absorption, scattering, thermalization, transport, etc., in macroscopic systems, including solution of the neutron transport equation and theoretical neutron transport in matter in general geometric configurations.

Nuclear Properties and Reactions $A \leqslant 5$ (68.200)

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

Nuclear Properties and Reactions $6 \leqslant A \leqslant 19$ (68.300)

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

Nuclear Properties and Reactions $20 \leqslant A \leqslant 38$ (68.400)

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

Nuclear Properties and Reactions $39 \leqslant A \leqslant 58$ (68.500)

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

Nuclear Properties and Reactions $59 \leqslant A \leqslant 89$ (68.600)

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

Nuclear Properties and Reactions $90 \leqslant A \leqslant 149$ (68.700)

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

Nuclear Properties and Reactions $150 \leqslant A \leqslant 189$ (68.800)

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

Nuclear Properties and Reactions $190 \leqslant A \leqslant 219$ (68.900)

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

Nuclear Properties and Reactions $A \geqslant 220$ (69.100)

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

Nuclear Theory (69.200)

Nuclear structure, nuclear matter, nuclear reactions and scattering, nuclear moments and spin, radioactive decay, spontaneous and induced fission, and nuclear models.

PHYSICS (PLASMA AND THERMONUCLEAR) (70.000)

This category has been renamed CONTROLLED THERMONUCLEAR RESEARCH. The Recon Number 70.000 was not changed.

PHYSICS (RADIATION AND SHIELDING) (72.000)

Radiation Physics (72.100)

Basic physical characteristics of radiation or of radiation passage through or scattering from materials not generally defined as shielding. This includes experimental or theoretical studies of range-energy relations, energy loss mechanisms, and absorption mechanisms, and calculations of dose distribution in tissue equivalent materials or phantoms. Dose determinations in biological materials is included under LIFE SCIENCES. Neutron transport in macroscopic systems is included under PHYSICS (NUCLEAR).

Radiation Protection Standards (72.200)

Standards written for a specific circumstance are included under appropriate sections.

Radiation Source Calibration and Standardization (72.300)

Radiation source design and fabrication or radiation source preparation are included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY or CHEMISTRY.

Shielding Calculations and Experiments (72.400)

Neutron shielding and shield fabrication are included under PHYSICS (NUCLEAR) and MATERIALS. Shield design is

included under sections for the application, e.g., PARTICLE ACCELERATORS or REACTOR TECHNOLOGY.

PHYSICS (THEORETICAL) (76.000)

General (76.100)

Theoretical physics applicable to nuclear science (e.g., general quantum theory and mathematical physics) but not specifically applied. Theoretical physics when applied is arranged according to application.

Quantum Field Theories (76.200)

Basic studies of quantum field theories and quantum electrodynamics.

Gravitation and General Relativity (76.300)

Basic studies of gravitation theory and general relativity theory. Gravitational collapse, gravitational wave detection, and tests of general relativity are included under PHYSICS (ASTROPHYSICS AND COSMOLOGY).

REACTOR TECHNOLOGY AND REGULATION (77.000)

Design, development, construction, and operation of nuclear fission reactors.

Includes: fuel elements; cooling systems; pressure vessels; shielding; loading machines; steam and power conversion systems; components; auxiliary systems; accessories.

Excludes: control systems (use 79.400); economics (use 79.500); fuel cycle economics (use 79.600); fuels, general aspects (use 79.300); safety and siting (use 77.900); nuclear insurance (use 77.910).

Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled (77.100)

Includes: BWR-type.

Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled (77.200)

Includes: PWR-type.

Power Reactors, Non-Breeding, Graphite Moderated (77.300)

Includes: GCR, AGR, HTGR, Molten Salt types.

Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated (77.400)

Includes: Heavy Water type.

Power Reactors, Breeding (77.500)

Includes: LMFBR, MSBR, GCFR.

Research, Test, Experimental, Zero-Power, and Training Reactors and Subcritical Assemblies (77.600)

Plutonium Production, Isotope Production, Chemonuclear, Materials Testing, and Material Processing Reactors (77.700)

Space, Mobile, Propulsion, Transportable, and Package Reactors (77.800)

Nuclear Ships Licensing and Regulation (77.810)

Safe-navigation regulations.

Reactor Safety and Environmental Aspects (77.900)

Reactor accident analysis, safety system performance (e.g., ECCS), environmental consequences of reactor construction and operation, including nonradioactive aspects, in-reactor facility waste processing and radiation protection.

Reactor Accident Liability (77.910)

Legal aspects of nuclear damage and risk, insurance, and financial security.

Reactor Theory and Calculation (79.100)

Reactor physics calculations and in-pile measurements (in reactors of any type).

Includes: criticality; dynamics; kinetics; lattice cell parameters; neutronics; physics; thermohydraulics.

Reactor Components and Accessories (79.200)

Design, construction, assembly, and performance—where no reactor type is specified.

Includes: buildings; coolants; cooling systems; loading machines; pressure vessels; shielding; structures.

Reactor Fuels (79.300)

Design, assembly, and performance of fuel elements and assemblies, fuel cycles, fuel handling procedures, and fuel requirements—where no reactor type is specified.

Excludes: production and fabrication of fuel element component materials; burnup in specific reactors types (use 77.100–77.800); fuel cycle economics (use 79.600); loading machines (use 79.200).

Reactor Control Systems (79.400)

Systems for the control and surveillance of reactors of any type.

Includes: control elements and incorporated instruments; control element drive units; control by computers; data processing and display systems; systems for alarm and automatic shutdown; automatic initiation of protective systems or actions.

Excludes: instruments of potential use in control systems; safety and protective systems (e.g., ECCS).

Nuclear Power Plant Economics (79.500)

General studies of power plant construction and operation. Excludes: fuel cycle economics (use 79.600).

Reactor Fuel Cycle Economics (79.600)

Fuel resources and requirements and overall fuel cycle costs.

Reactor Licensing and Regulation (79.700)

All reactor Docket material (must have secondary category to type, e.g., 77.100, 77.200, and any other appropriate category), general licensing procedures and regulations.

GENERAL (80.000)

Civilian Defense (80.100)

Administrative and planning aspects only.

Energy Utilization and Economics (80.200)

Economic and feasibility studies of nonnuclear energy source development and utilization.

Note: only ERDA-sponsored reports that are not announced in the journal *Energy Abstracts for Policy Analysis (EAPA)* are included.

Information Handling (80.300)

Manual or computer-based systems for data or information acquisition, processing, transmission and retrieval.

Law (80.400)

Legislative action and activities of agencies, committees, or organizations.

Management (80.500)

Organization, administration, financing, and general description of nuclear institutes and programs, e.g., directories, reference books, manuals, lists of publications, general bibliographies, training programs, etc.

Mathematics and Computers (80.600)

Mathematical methods and models and computer codes and programs for solving problems not related to nuclear science.

Miscellaneous (80.700)

Publicly available administrative and research and development reports from the Energy Research and Development Administration and the national nuclear energy organizations of the United Kingdom, Canada, Sweden, Denmark, Japan, Australia, France, West Germany, and Norway which are outside the subject scope of other categories.

Chemistry (80.710)

Life Sciences (80.720)

Materials (80.730)

Physics and Engineering (80.740)

Part 2

EXTENT OF INTEREST IN THE ELEMENTS

ACTINIUM

All scientific and technical aspects

ALUMINUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

AMERICIUM

All scientific and technical aspects

ANTIMONY

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

ARGON

Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

ARSENIC

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

ASTATINE

All scientific and technical aspects

BARIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

BERKELIUM

All scientific and technical aspects

BERYLLIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

BISMUTH

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of liquid bismuth

Nuclear properties and nuclear reactions

Radiation effects
Radiochemistry

BORON

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

BROMINE

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

CADMIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

CALCIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

CALIFORNIUM

All scientific and technical aspects

CARBON

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Properties and fabrication of nuclear-grade graphite and graphite fuel materials
Radiation effects
Radiochemistry

CERIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

CESIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

CHLORINE

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

CHROMIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

COBALT

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

COPPER

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

CURIUM

All scientific and technical aspects

DYSPROSIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application) compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

EINSTEINIUM

All scientific and technical aspects

ERBIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

EUROPIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

FERMIUM

All scientific and technical aspects

FLUORINE

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

FRANCIUM

All scientific and technical aspects

GADOLINIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

GALLIUM

Applications of the element and its alloys, compounds, and systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

GERMANIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

GOLD

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

HAFNIUM

Applications of the element and its alloys, compounds, and systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

HELIUM

Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Superfluidity

HOLMIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

HYDROGEN

Applications of the element or its compounds and systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of deuterium and tritium
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

INDIUM

Applications of the element and its alloys, compounds, and systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

IODINE

Analysis, determination, and separation

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

IRIDIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

IRON

Applications of the element and its alloys or systems, including steel and stainless steel, in nuclear technology or the behavior of the element, its alloys, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

KRYPTON

Analysis, determination, and separation

Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

LANTHANUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

LAWRENCIUM (103)

All scientific and technical information

LEAD

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

LITHIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

LUTETIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

MAGNESIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

MANGANESE

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

MENDELEVIUM

All scientific and technical aspects

MERCURY

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

MOLYBDENUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

NEODYMIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys, compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

NEON

Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

NEPTUNIUM

All scientific and technical aspects

NICKEL

Applications of the element or its alloys, compounds, or systems, in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

NIOBIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element,

its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

NITROGEN

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

NOBELIUM

All scientific and technical aspects

OSMIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

OXYGEN

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

PALLADIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

PHOSPHORUS

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

PLATINUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

PLUTONIUM

All scientific and technical aspects

POLONIUM

All scientific and technical aspects

POTASSIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

PRASEODYMIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

PROMETHIUM

All scientific and technical aspects

PROTACTINIUM

All scientific and technical aspects

RADIUM

All scientific and technical aspects

RADON

All scientific and technical aspects

RHENIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

RHODIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

RUBIDIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

RUTHENIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

SAMARIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

SCANDIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

SELENIUM

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its

compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

SILICON

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

SILVER

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

SODIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of liquid sodium in cooling systems
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

STRONTIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

SULFUR

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

TANTALUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

TECHNETIUM

All scientific and technical aspects

TELLURIUM

Analysis, determination, and separation
Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

TERBIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual

or simulated nuclear application), compounds, or systems, excluding mineralogy
Radiation effects
Radiochemistry
Solid-state properties

THALLIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

THORIUM

All scientific and technical aspects except mining and routine industrial uses, e.g., thoriated cathodes

THULIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

TIN

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

TITANIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

TRANSLAWRENCIUM ELEMENTS

All scientific and technical aspects

TUNGSTEN

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

URANIUM

All scientific and technical aspects except mining and routine industrial applications

VANADIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steel containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

XENON

Analysis, determination, and separation
Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

YTTERBIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

YTTRIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

ZINC

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

ZIRCONIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
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The foreign language journals in this list available in English language translation are indicated and the title of the English language journal is included.

TID-4579-R8 *Serial Titles Cited in Nuclear Science Abstracts* lists the titles and abbreviations of the journals regularly scanned for *NSA* as well as those from which an occasional item is taken. This publication is available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161, in full size or microfiche copy.

A

Acc. Chem. Res.
Accounts of Chemical Research (U.S.)

Acta Agron. Acad. Sci. Hung.
Acta Agronomica Academiae Scientarum Hungaricae (formerly carried as Acta Agron. (Budapest)) (Hungary)

Acta Aliment. Acad. Sci. Hung.
Acta Alimentaria Academiae Scientiarum Hungaricae (Hungary)

Acta Allergol.
Acta Allergologica (Denmark)

Acta Amazonica
Acta Amazonica (Brazil)

Acta Anaesthesiol. Scand.
Acta Anaesthesiologica Scandinavica (Denmark)

Acta Astron.
Acta Astronomica, Polska Akademia Nauk (Formed by Merger of Acta Astronomica, Ser. A, Ser. B, and Ser. C) (Poland)

Acta Biochim. Biophys. Acad. Sci. Hung.
Acta Biochimica et Biophysica, Academiae Scientiarum Hungaricae (Budapest) (Hungary)

Acta Biochim. Pol.
Acta Biochimica Polonica (Poland)

Acta Biol. Cracov., Ser. Zool.
Acta Biologica Cracoviensia, Serie Zoologie (Poland)

Acta Bot. Neerl.
Acta Botanica Neerlandica (Netherlands)
Supersedes Nederlandsch Kruidkundig Archief and Recueil des Travaux Botaniques Nederlandais

Acta Chem. Scand.
Acta Chemica Scandinavica (Denmark)
Divided into Acta Chem. Scand., Ser. A and Ser. B

Acta Chim. Acad. Sci. Hung.
Acta Chimica Academiae Scientiarum Hungaricae (Hungary)

Acta Chir. Belg.
Acta Chirurgica Belgica (Belgium)

Acta Crystallogr., Sect. A
Acta Crystallographica, Section A. Crystal Physics, Diffraction, Theoretical and General Crystallography (Continues in Part Acta Crystallographica) (Denmark)

Acta Crystallogr., Sect. B
Acta Crystallographica, Section B. Structural Crystallography and Crystal Chemistry (Continues in Part Acta Crystallographica) (Denmark)

Acta Electron.
Acta Electronica (France)

Acta Endocrinol.
Acta Endocrinologica (Denmark)

Acta Fac. Rerum Nat. Univ. Comenianae, Phys.
Acta Facultatis Rerum Naturalium Universitatis Comenianae, Physica (Czechoslovakia)

Acta Geophys. Pol.
Acta Geophysica Polonica (Poland)

Acta Haematol.
Acta Haematologica. International Journal of Hematology (Switzerland)

Acta Haematol. Pol.
Acta Haematologica Polonica (Poland)

Acta Hydrobiol.
Acta Hydrobiologica, Polska Akademia Nauk, Zaklad Biologii Wod (Poland)

Acta Mech.
Acta Mechanica (Austria - U.S.)

Acta Med. Bulg.
Acta Medica Bulgarica (Bulgaria)

Acta Metall.
Acta Metallurgica (U.S.)

Acta Mex. Cienc. Tecnol.
Acta Mexicana de Ciencia y Tecnologia (Mexico)

Acta Microbiol. Pol., Ser. A
Acta Microbiologica Polonica, Series A. Microbiologia Generalis (Poland)

Acta Microbiol. Pol., Ser. B
Acta Microbiologica Polonica, Series B. Microbiologia Applicata (Poland)

Acta Neurol. (Naples)
Acta Neurologica (Naples) (Italy)

Acta Neurol. Scand.
Acta Neurologica Scandinavica. (Denmark)

Acta Odontol. Scand.
Acta Odontologica Scandinavica (Sweden)

Acta Oto-Rhino-Laryngol. Belg.
Acta Oto-Rhino-Laryngologica Belgica (Belgium)

Acta Pathol. Jpn.
Acta Pathologica Japonica (Japan)

Acta Pharmacol. Toxicol.
Acta Pharmacologica et Toxicologica (Denmark)

Acta Phys. Acad. Sci. Hung.
Acta Physica Academiae Scientiarum Hungaricae (Hungary)

Acta Phys. Austriaca
Acta Physica Austriaca (Austria)

Acta Phys. Austriaca, Suppl.
Acta Physica Austriaca, Supplementum (Austria)

Acta Physiol. Acad. Sci. Hung.
Acta Physiologica Academiae Scientiarum Hungaricae (Hungary)

Acta Physiol. Pol.
Acta Physiologica Polonica (Poland)

Acta Physiol. Scand.
Acta Physiologica Scandinavica (Sweden)

Acta Phys. Pol.
Acta Physica Polonica (Poland)
Divided into Series A and B, Beginning January 1970

Acta Phys. Pol., Ser. A
Acta Physica Polonica, A (Poland)

Acta Phys. Pol., Ser. B
Acta Physica Polonica, B (Poland)

Acta Phys. Slovaca
Acta Physica Slovaca (Czechoslovakia)
Supersedes Fyz. Cas.

Acta Pol. Pharm.
Acta Poloniae Pharmaceutica (Poland)

Acta Polytech. (Prague) IV
Acta Polytechnica (Prague), (Rada) IV. Technicko-Teoreticka (Czechoslovakia)

Acta Radiol., Diagn.
Acta Radiologica, Diagnosis (Sweden)

Acta Radiol., Suppl.
Acta Radiologica, Supplementum (Sweden)

Acta Radiol., Ther., Phys., Biol.
Acta Radiologica, Therapy, Physics, Biology (Sweden)

Acta Soc. Bot. Pol.
Acta Societatis Botanicorum Poloniae (Poland)

Acta Stomatol. Belg.
Acta Stomatologica Belgica (Belgium)

Acta Stomatol. Croat.
Acta Stomatologica Croatica (Yugoslavia)

Acta Tech. Acad. Sci. Hung.
Acta Technica Academiae Scientiarum Hungaricae (Hungary)

Acta Univ. Carolinae, Med., Monogr.
Acta Universitatis Carolinae, Medica, Monographia (Czechoslovakia)

Acta Univ. Szeged., Acta Phys. Chem.
Acta Universitatis Szegediensis, Acta Physica et Chemica (Hungary)

Acta Vitaminol.
Acta Vitaminologica. (Italy)
Superseded by Acta Vitaminologica et Enzymologica

Acta Vitaminol. Enzymol.
Acta Vitaminologica et Enzymologica (Formerly Acta Vitaminologica) (Italy)

Adv. At. Mol. Phys.
Advances in Atomic and Molecular Physics (U.S.)

Adv. Biosci.
Advances in the Biosciences (England)

Adv. Hum. Genet.
Advances in Human Genetics (U. S.)

Adv. Nucl. Sci. Technol.
Advances in Nuclear Science and Technology (U.S.)

Adv. Phys.
Advances in Physics (England)

Adv. Radiat. Biol.
Advances in Radiation Biology (U.S.)

Adv. Vet. Sci. Comp. Med
Advances in Veterinary Science and Comparative Medicine (U.S)
Supersedes Adv. Vet. Sci.

Adv. X-Ray Anal.
Advances in X-Ray Analysis (U.S.)

Aerosol Sci.
Aerosol Science (England)

Aerosp. Med.
Aerospace Medicine (Formerly The Journal of Aviation Medicine) (U. S.)
Superseded by Aviat., Space Environ. Med.

Agric. Biol. Chem. (Tokyo)
Agricultural and Biological Chemistry (Tokyo) (Japan)

Agrochemophysica
Agrochemophysica (South Africa)

Agrokem. Talajtan
Agrokemia es Talajtan (Hungary)

Agron. Trop. (Paris)
Agronomie Tropicale (Paris) (France)

Agroplantae
Agroplantae (South Africa)

AIAA (Am. Inst. Aeronaut. Astronaut.) J.
AIAA (American Institute of Aeronautics and Astronautics) Journal (Combining the ARS Journal and the Journal of Aerospace Science) (U.S.)

AIAA (Am. Inst. Aeronaut. Astronaut.) Stud. J.
AIAA (American Institute of Aeronautics and Astronautics) Student Journal (U.S.)

AIChE (Am. Inst. Chem. Eng.) J.
AIChE (American Institute of Chemical Engineers) Journal (U.S.)

AIChE (Am. Inst. Chem. Eng.) Symp. Ser.
AIChE Symposium Series (U.S.)
Supersedes Chem. Eng. Progr., Symp. Ser.

AIP (Am. Inst. Phys.) Conf. Proc.
AIP (American Institute of Physics) Conference Proceedings (U.S.)

Akita Daigaku Kozangakubu Chika Shigen Kenkyushisetsu Hokoku
Akita Daigaku Kozangakubu Chika Shigen Kenkyushisetsu Hokoku (Report of the Research Institute of Underground Resources Mining College, Akita University) (Japan)

Akush. Ginekol.
Akusherstvo i Ginekologiya (U.S.S.R.)

Allg. Prakt. Chem.
Allgemeine und Praktische Chemie (Austria)

Alloy Dig.
Alloy Digest (U.S.)

Alta Freq.
Alta Frequenza. Rivista di Radiotecnica, Telefonia e Acustica Applicata (Italy)

Ambio
Ambio (Norway)

Am. Ceram. Soc. Bull.
American Ceramic Society Bulletin, The (U.S.)

AMDEL (Aust. Miner. Dev. Lab.) Bull.
AMDEL (Australian Mineral Development Laboratories) Bulletin (Australia)

Am. Heart J.
American Heart Journal (U.S.)

Am. Ind. Hyg. Assoc. J.
American Industrial Hygiene Association Journal (U.S.)

Am. J. Anat.
American Journal of Anatomy, The (U.S.)

Am. J. Cardiol.
American Journal of Cardiology, The (U.S.)

Am. J. Clin. Nutr.
American Journal of Clinical Nutrition, The (U.S.)

Am. J. Dig. Dis.
American Journal of Digestive Diseases, The (U.S.)

Am. J. Dis. Child.
American Journal of Diseases of Children (U.S.)

Am. J. Hosp. Pharm.
American Journal of Hospital Pharmacy (U.S.)

Am. J. Med.
American Journal of Medicine, The (U.S.)ncy

Am. J. Med. Sci.
American Journal of the Medical Sciences, The (U.S.)

Am. J. Obstet. Gynecol.
American Journal of Obstetrics and Gynecology (U.S.)

Am. J. Pathol.
American Journal of Pathology, The (U.S.)

Am. J. Phys.
American Journal of Physics (U.S.)

Am. J. Physiol.
American Journal of Physiology, The (U.S.)

Am. J. Public Health
American Journal of Public Health (U.S.)

Am. J. Roentgenol., Radium Ther. Nucl. Med.
American Journal of Reontgenology, Radium Therapy and Nuclear Medicine, The (U.S.)

Am. J. Surg.
American Journal of Surgery, The (U.S.)

Am. J. Vet. Res.
American Journal of Veterinary Research (U.S.)

Am. Met. Mark.
American Metal Market (U.S.)

Am. Midl. Nat.
American Midland Naturalist (U.S.)

Am. Mineral.
American Mineralogist, The (U.S.)

Am. Rev. Respir. Dis.
American Review of Respiratory Diseases (U.S.)

Am. Sci.
American Scientist (U.S.)

Am. Soc. Test. Mater., Spec. Tech. Publ.
American Society for Testing and Materials, Special Technical Publication (U. S.)

An. Acad. Bras. Cienc.
Anais da Academia Brasileira de Ciencias (Brazil)

Anal. Biochem.
Analytical Biochemistry (U.S.)

Anal. Chem.
Analytical Chemistry (U.S.)

Anal. Chim. Acta
Analytica Chimica Acta (Netherlands)

Anal. Lett.
Analytical Letters (U.S.)

Analusis
Analusis (France)

Analyst
Analyst, The (England)

An. Espan. Odontestomatol.
Anales Espanoles de Odontoestomatologia (Spain)

Angew. Bot.
Angewandte Botanik (West Germany)

Angew. Chem.
Angewandte Chemie (West Germany)

Angew. Chem. Int. Ed. Engl.
Angewandte Chemie. International Edition in English (U.S.-West Germany)

Angiologia (Barcelona)
Angiologia (Barcelona) (Spain)

Angiologica
Angiologica (Switzerland)

Angiology
Angiology (U.S.)

Ann. Biol. Clin. (Paris)
Annales de Biologie Clinique (Paris) (France)

Ann. Chem.
Annalen der Chemie, Justus Liebigs (West Germany)

Ann. Chir. Plast.
Annales de Chirurgie Plastique (France)

Ann. Endocrinol. (Paris)
Annales d'Endocrinologie (Paris) (France)

Ann. Entomol. Soc. Am.
Annals of the Entomological Society of America (U.S.)

Ann. Gastroenterol. Hepatol.
Annales de Gastroenterologie et d'Hepatologie (France)

Ann. Geophys.
Annales de Geophysique (France)

Ann. Inst. Henri Poincare, Sect. A
Annales de l'Institut Henri Poincare, Section A. Physique Theorique (France)

Ann. Inst. Oceanogr.
Annales de l'Institut Oceanographique (Paris) (France)

Ann. Intern. Med.
Annals of Internal Medicine (U.S.)

Ann. Ist. Super. Sanita
Annali dell' Istituto Superiore di Sanita (Italy)

Ann. Mat. Pura Appl.
Annali di Matematica Pura ed Applicata (Italy)

Ann. Mines
Annales des Mines (France)

Ann. Nucl. Sci. Eng.
Annals of Nuclear Science and Engineering (England)
Supersedes J. Nucl. Energy
Changed to Ann. Nucl. Energy

Ann. N.Y. Acad. Sci.
Annals of the New York Academy of Sciences (U.S.)

Ann. Occup. Hyg.
Annals of Occupational Hygiene, The (England)

Ann. Ophthalmol.
Annals of Ophthalmology (U.S.)

Ann. Otol., Rhinol., Laryngol.
Annals of Otology, Rhinology, and Laryngology (U.S.)

Ann. Pediatr.
Annales de Pediatrie (Paris) (France)

Ann. Pharm. Fr.
Annales Pharmaceutiques Francaises (France)

Ann. Pharm. (Poznan)
Annales Pharmaceutici (Poznan) (Poland)

Ann. Phys. Biol. Med.
Annales de Physique Biologique et Medicale (France)

Ann. Phys. (Leipzig)
Annalen der Physik (Leipzig) (East Germany)

Ann. Phys. (N.Y.)
Annals of Physics (New York) (U.S.)

Ann. Phys. (Paris)
Annales de Physique (Paris) (France)

Ann. Radiol.
Annales de Radiologie (France)

Ann. Rheum. Dis.
Annals of the Rheumatic Diseases (England)

Ann. Soc. Sci. Brux. Ser. I
Annales de la Societe Scientifique de Bruxelles. Serie I (Belgium)

Ann. Surg.
Annals of Surgery (U.S.)

Annu. Rep. Prog. Chem., Sect. A
Annual Reports on the Progress of Chemistry, Section A. General, Physical and Inorganic Chemistry (England)

Annu. Rep. Radiat. Center Osaka Prefect.
Annual Report of the Radiation Center of Osaka Prefecture (Japan)

Annu. Rep. Res. Reactor Inst., Kyoto Univ.
Annual Reports of the Research Reactor Institute, Kyoto University (Japan)

Annu. Rev. Astron. Astrophys.
Annual Review of Astronomy and Astrophysics (U.S.)

Annu. Rev. Earth Planet. Sci.
Annual Review of Earth and Planetary Sciences (U.S.)

Annu. Rev. Nucl. Sci.
Annual Review of Nuclear Science (U.S.)

Antarct. J. U. S.
Antarctic Journal of the United States (U.S.)

Antarktika
Antarktika (U.S.S.R.)

Antibiotiki
Antibiotiki (U.S.S.R.)

Antiseptic
Antiseptic (India)

Apidologie
Apidologie (France)
Supersedes Annales de l'Abeille

Appl. Microbiol.
Applied Microbiology (U.S.)

Appl. Opt.
Applied Optics (U.S.)

Appl. Phys.
Applied Physics (West Germany - U.S.)

Appl. Phys. Lett.
Applied Physics Letters (U.S.)

Appl. Sci. Res. (The Hague)
Applied Scientific Research (The Hague) (Netherlands)

Appl. Spectrosc.
Applied Spectroscopy (U.S.)

App. Metody Rentgenovskogo Anal.
Apparatura i Metody Rentgenovskogo Analiza (U.S.S.R.)

Arbeitsschutz (Cologne)
Arbeitsschutz (Cologne) (West Germany)

Archaeometry
Archaeometry (England)

Arch. Dermatol.
Archives of Dermatology (U.S.)

Arch. Dermatol. Forsch.
Archiv fuer Dermatologische Forschung (West Germany)
Supersedes Arch. Klin. Exp. Dermatol.

Arch. Eisenhuettenwes.
Archiv fuer das Eisenhuettenwesen (West Germany)

Arch. Energiewirtsch.
Archiv fuer Energiewirtschaft (West Germany)

Arch. Environ. Health
Archives of Environmental Health (Formerly A.M.A. Archives of Industrial Health) (U.S.)

Arch. Gefluegelkd.
Archiv fuer Gefluegelkunde (West Germany)

Arch. Gesamte Virusforsch.
Archiv fuer die Gesamte Virusforschung (Austria)
Changed to Arch. Virol.

Arch. Geschwulstforsch.
Archiv fuer Geschwulstforschung (East Germany)

Arch. Gynaekol.
Archiv fuer Gynaekologie (West Germany)

Arch. Hutn.
Archiwum Hutnictwa (Poland)

Arch. Hydrobiol.
Archiv fuer Hydrobiologie (West Germany)

Arch. Immunol. Ther. Exp.
Archivum Immunologiae et Therapiae Experimentalis (Poland)

Arch. Inst. Cardiol. Mex.
Archivos del Instituto de Cardiologia de Mexico (Mexico)

Arch. Int. Pharmacodyn.
Archives Internationales de Pharmacodynamie et de Therapie (Belgium)

Arch. Invest. Med.
Archivos de Investigacion Medica (Mexico)

Arch. Klin. Exp. Ohren-, Nasen- Kehlkopfheilkd.
Archiv fuer Klinische und Experimentelle Ohren-, Nasen- und Kehlkopfheilkunde (West Germany)

Arch. Lebensmittelhyg.
Archiv fuer Lebensmittelhygiene Insbesondere fuer Fleisch, Fisch, und Milchhygiene (West Germany)

Arch. Mech. Stosow.
Archiwum Mechaniki Stosowanej (Poland)

Arch. Meteorol., Geophys. Bioklimatol., Ser. B
Archiv fuer Meteorologie, Geophysik und Bioklimatologie, Series B (Austria)

Arch. Oral Biol.
Archives of Oral Biology (England)

Arch. Otolaryngol.
Archives of Otolaryngology (U.S.)

Arch. Pathol.
Archives of Pathology (Formerly A.M.A. Archives of Pathology) (U.S.)

Arch. Surg. (Chicago)
Archives of Surgery (Chicago) (U. S.)

Arch. Tech. Mess. Messtech. Prax.
Archiv fuer Technisches Messen und Messtechnische Praxis (West Germany)
Supersedes Arch. Tech. Mes.

Arch. Toxikol.
Archiv fuer Toxikologie (West Germany)

Argent. Electroenerg.
Argentina Electroenergetica (Argentina)

Arh. Hig. Rada Toksikol.
Arhiv za Higijenu Rada i Toksikologiju (Yugoslavia)

Ark. Fys. Semin. Trondheim
Arkiv for det Fysiske Seminar i Trondheim (Norway)

Ark. Geofys.
Arkiv for Geofysik, Utgivet av Kungliga Svenska Vetenskapsakademien (Sweden)
Discontinued

Arkh. Patol.
Arkhiv Patologii (U.S.S.R.)

Arm. Khim. Zh.
Armyanskii Khimicheskii Zhurnal (Formerly Izvestiya Akademii Nauk Armyanskoi SSR, Khimicheskie Nauk) (Armenian S.S.R.)

Arq. Patol. (Lisbon)
Arquivos de Patologia (Lisbon) (Portugal)

Arthritis Rheum.
Arthritis and Rheumatism (U.S.)

Astrometriya Astrofiz.
Astrometriya i Astrofizika (Ukrainian S.S.R.)

Astron. Astrophys.
Astronomy and Astrophysics (Formed by the Merging of Annales d'Astrophysique, Bulletin of the Astronomical Institutes of the Netherlands, Bulletin Astronomique, Journal des Observateurs, and Zeitschrift fuer Astrophysik) (West Germany - U.S.)

Astron. Astrophys., Suppl. Ser.
Astronomy and Astrophysics, Supplement Series (Switzerland)

Astronaut. Acta
Astronautica Acta (Austria)

Astronaut. Aeronaut.
Astronautics and Aeronautics (Formerly Astronautics and Aerospace Engineering) (U.S.)

Astron. J.
Astronomical Journal, The (U.S.)

Astron. Nachr.
Astronomische Nachrichten (East Germany)

Astronomie
Astronomie, L (France)

Astron. Tidsskr.
Astronomisk Tidsskrift (Norway)

Astron. Tsirk.
Astronomicheskii Tsirkulyar (U.S.S.R.)

Astrophysics (Engl. Transl.)
Astrophysics (English Translation of Astrofizika) (U.S.)

Astrophys. J.
Astrophysical Journal, The (U.S.)

Astrophys. J., Lett.
Astrophysical Journal, The, Letters to the Editor (U.S.)

Astrophys. J., Suppl. Ser.
Astrophysical Journal, The, Supplement Series (U.S.)

Astrophys. Lett.
Astrophysical Letters (Scotland)

Astrophys. Space Sci.
Astrophysics and Space Science (Netherlands)

Astrophys. Space Sci. Libr.
Astrophysics and Space Science Library (Netherlands)

At. Data Nucl. Data Tables
Atomic Data and Nuclear Data Tables (formerly carried under titles: Nucl. Data, Sect. A; and Nucl. Data Tables) (U.S.)

Ateneo Parmense, Sez. 1
Ateneo Parmense, Sezione 1. Acta Bio-Medica (Italy)

At. Energ. (USSR)
Atomnaya Energiya (U.S.S.R.)
Issued in English Translation as Soviet Journal of Atomic Energy, The

At. Energy Aust.
Atomic Energy in Australia (Australia)

At. Energy Law J.
Atomic Energy Law Journal (U.S.)

At. Energy Rev.
Atomic Energy Review (Austria)

Atherosclerosis
Atherosclerosis (Netherlands)
Supersedes Journal of Atherosclerosis Research

At. Inf.
Atom Informationen (West Germany)

At. Jpn.
Atoms in Japan (Japan)

Atmos. Environ.
Atmospheric Environment (England)

Atomkernenergie
Atomkernenergie (Formerly Atomenergie) (West Germany)

ATOMKI (At. Kut. Intez.) Kozl.
ATOMKI (Atommag Kutato Intezet) Kozlemenyek (Hungary)

ATOMKI (At. Kut. Intez.) Kozlem., Suppl.
ATOMKI (Atommag Kutato Intezet) Kozlemenyek, Supplement (Hungary)

Atom (London)
Atom (London) (England)

Atomwirtsch., Atomtech.
Atomwirtschaft, Atomtechnik (Formerly Atomwirtschaft, Die) (West Germany)

Atoomenerg. Haar Toepass.
Atoomenergie en Haar Toepassingen (Formerly RCN Bulletin) (Netherlands)

At. Strom
Atom und Strom (West Germany)

Atsuryoku Gijutsu
Atsuryoku Gijutsu (Pressure Engineering) (Japan)

At. Tekh. Rubezhom
Atomnaya Tekhnika za Rubezhom (U.S.S.R.)

Atti Accad. Naz. Lincei, Rend., Cl. Sci. Fis., Mat. Nat.
Atti della Accademia Nazionale dei Lincei, Rendiconti, Classe di Scienze Fisiche, Matematiche e Naturali (Italy)

Atti Accad. Sci. Torino. I. Cl. Sci. Fis., Mat. Nat.
Atti della Accademia delle Scienze di Torino. (Part) I. Classe di Scienze Fisiche, Matematiche e Naturali (Italy)

Aust. J. Chem.
Australian Journal of Chemistry (Australia)

Aust. J. Exp. Biol. Med. Sci.
Australian Journal of Experimental Biology and Medical Science, The (Australia)

Aust. J. Med. Technol.
Australian Journal of Medical Technology (Australia)

Aust. J. Phys.
Australian Journal of Physics (Australia)

Aust. J. Phys., Astrophys. Suppl.
Australian Journal of Physics, Astrophysical Supplement (Australia)

Aust. J. Soil Res.
Australian Journal of Soil Research (Australia)

Aust. Libr. J.
Australian Library Journal, The (Australia)

Aust. Min.
Australian Mining (Australia)

Aust. N.Z. J. Surg.
Australian and New Zealand Journal of Surgery (Australia)

Aust. Phys.
Australian Physicist (Australia)

Australas. Inst. Min. Metall. Proc.
Australasian Institute of Mining and Metallurgy Proceedings (Australia)

Aust. Vet. J.
Australian Veterinary Journal (Australia)

Automatisme
Automatisme (France)

Automaz. Strum.
Automazione e Strumentazione (Italy)

Avtomatika
Avtomatika (Ukrainian S.S.R.)
Issued in English translation as Sov. Automat. Contr.

Avtomat. Svarka
Avtomaticheskaya Svarka (Ukrainian S.S.R.) Issued in English Translation as Automatic Welding (USSR)

Aware
Aware (U.S.)

Azerb. Neft. Khoz.
Azerbaidzhanskoe Neftyanoe Khozyaistvo (Azerbaidzhan S.S.R.)

B

Bacteriol. Rev.
Bacteriological Reviews (U.S.)

Baender, Bleche, Rohre
Baender, Bleche, Rohre (West Germany)

Banyasz. Kohasz. Lapok, Kohasz.
Banyaszati es Kohaszati Lapok, Kohaszat (Hungary)
Supersedes Kohasz. Lapok

Banyasz. Kut. Intez. Kozlem.
Banyaszati Kutato Intezet Kozlemenyei (Hungary)

Basic Res. Cardiol.
Basic Research in Cardiology (West Germany)
Supersedes Arch. Kreislaufforsch.

Bautechnik
Bautechnik, Die (West Germany)

BBC-Nachr.
BBC-Nachrichten (Switzerland)

B. C. Prof. Eng.
B. C. Professional Engineer (Canada)

Beitr. Pathol.
Beitraege zur Pathologie (West Germany)
Supersedes Beitraege zur Pathologischen Anatomie und zur Allgemeinen Pathologie

Beitr. Plasmaphys.
Beitraege aus der Plasmaphysik (East Germany)

Belg.-Ned. Tijdschr. Oppervlakte Tech. Met.
Belgisch-Nederlands Tijdschrift voor Oppervlakte Technieken van Metalen (Netherlands)

Ber. Bunsenges. Phys. Chem.
Berichte der Bunsengesellschaft fuer Physikalische Chemie (Formerly Zeitschrift fuer Elektrochemie) (West Germany)

Ber. Dtsch. Keram. Ges.
Berichte der Deutschen Keramischen Gesellschaft E. V. (West Germany)

Berg- Huettenmaenn. Monatsh.
Berg- und Huettenmaennische Monatshefte (Austria)

Berufsdermatosen
Berufsdermatosen. Occupational Dermatoses (West Germany)

Beton Stahlbetonbau
Beton- und Stahlbetonbau (West Germany)

Bibl. Anat.
Bibliotheca Anatomica (Switzerland)

Bibl. Haematol.
Bibliotheca Haematologica, Supplementa ad Acta Haematologica (Switzerland)

Bild Wiss.
Bild der Wissenschaft (West Germany)

Biochem. Biophys. Res. Commun.
Biochemical and Biophysical Research Communications (U.S.)

Biochem. Genet.
Biochemical Genetics (U.S.)

Biochemistry
Biochemistry (U.S.)

Biochem. J.
Biochemical Journal (England)

Biochem. Med.
Biochemical Medicine (U.S.)

Biochim. Biophys. Acta
Biochimica et Biophysica Acta (Netherlands)

Biofizika
Biofizika (U.S.S.R.) For English Translation see Biophysics (USSR)

Biokhimiya
Biokhimiya (U.S.S.R.) For English Translation see Biochemistry (USSR) (U.S.)

Biol. Nauki
Biologicheskie Nauki (U.S.S.R.)

Biol. Neonate
Biology of the Neonate (Switzerland)
Supersedes Biol. Neonatorum

Biologia (Bratislava)
Biologia (Bratislava) (Czechoslovakia)

Biol. Vnutr. Vod, Inf. Byull.
Biologiya Vnutrennikh Vod, Informatsionnyi Byulleten (U.S.S.R.)

Biol. Zh. Arm.
Biologicheskii Zhurnal Armenii (Formerly Izvestiya Akademii Nauk Armyanskoi SSR, Biologicheskie Nauki) (Armenian S.S.R.)

Biomedicine
Biomedicine (France)
Supersedes Rev. Eur. Etud. Clin. Biol.

Biomembranes
Biomembranes (U.S.)

Biophysics (USSR) (Engl. Transl.)
Biophysics (USSR) (English Translation of Biofizika) (England)

Biophys. J.
Biophysical Journal (U.S.)

Biotechniek
Biotechniek (Netherlands)

Bitamin
Bitamin (Vitamins) (Japan)

Biul., Inst. Genet. Hodowli Zwierzat Pol. Akad. Nauk
Biuletyn, Instytut Genetyki i Hodowli Zwierzat Polskiej Akademii Nauk (Poland)
Superseded by Pr. Mater. Zootech.

Blood
Blood. The Journal of Hematology (U.S.)

Blut
Blut. Zeitschrift fuer Gesamte Blutforschung (West Germany)

Bol. Acad. Cienc. Fis., Mat. Nat., Caracas
Boletin de la Academia de Ciencias Fisicas, Matematicas y Naturales, Caracas (Venezuela)

Bol. Cent. Nav.
Boletin del Centro Naval (Argentina)

Boll. Lab. Entomol. Agrar. Portici
Bollettino del Laboratorio di Entomologia Agraria "Filippo Silvestri" di Portici (Italy)

Boll. Soc. Geol. Ital.
Bollettino della Societa Geologica Italiana (Italy)

Boll. Soc. Ital. Biol. Sper.
Bollettino della Societa Italiana di Biologia Sperimentale (Italy)

Bot. Gaz. (Chicago)
Botanical Gazette (Chicago) (U.S.)

Bot. Zh.
Botanicheskii Zhurnal (U.S.S.R.)

Boundary-Layer Meteorol.
Boundary-Layer Meteorology (Netherlands)

Brain Res.
Brain Research (Netherlands)

Brandschutz
Brandschutz (West Germany)

Bratisl. Lek. Listy
Bratislavske Lekarske Listy (Czechoslovakia)

Braunkohle
Braunkohle. Waerme und Energie. Zeitschrift fuer Gewinnung und Verwertung der Brauhkohle (West Germany)

Brennst.-Waerme-Kraft
Brennstoff-Waerme-Kraft (West Germany)

Br. J. Cancer
British Journal of Cancer (England)

Br. J. Dermatol.
British Journal of Dermatology (England)

Br. J. Exp. Pathol.
British Journal of Experimental Pathology (England)

Br. J. Haematol.
British Journal of Haematology (England)

Br. J. Non-Destr. Test.
British Journal of Non-Destructive Testing (England)

Br. J. Radiol.
British Journal of Radiology (England)

Br. J. Urol.
British Journal of Urology, The (Scotland)

Brown Boveri Rev.
Brown Boveri Review (Switzerland)

Br. Steel Corp., Open Rep.
British Steel Corporation, Open Report (England)

Bulg. J. Phys.
Bulgarian Journal of Physics (Bulgaria)
Supersedes Izv. Fiz. Inst. Aneb, Bulg. Akad. Nauk. and Izv. Inst. Elektron., Bulg. Akad. Nauk.

Bull. Acad. Pol. Sci., Ser. Sci. Biol.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences Biologiques (Poland)

Bull. Acad. Pol. Sci., Ser. Sci. Chim.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences Chimiques (Poland)

Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences, Mathematiques, Astronomiques et Physiques (Poland)

Bull. Acad. Pol. Sci., Ser. Sci. Tech.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences Techniques (Poland)

Bull. Acad. Sci. USSR, Div. Chem. Sci.
Bulletin of the Academy of Sciences, USSR, Division of Chemical Science (English Translation of Izvestiya Akademii Nauk SSSR, Seriya Khimicheskaya) (U.S.)

Bull. Acad. Sci. USSR, Phys. Ser.
Bulletin of the Academy of Sciences of the USSR, Physical Series (English Translation of Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya) (U.S.)

Bull. Astron. Inst. Czech.
Bulletin of the Astronomical Institutes of Czechoslovakia (Czechoslovakia)

Bull. Chem. Soc. Jpn.
Bulletin of the Chemical Society of Japan (Japan)

Bull. Cl. Sci., Acad. R. Belg.
Bulletin de la Classe des Sciences, Academie Royale de Belgique (Belgium)

Bull. Coll. Sci., Univ. Baghdad
Bulletin of the College of Science, University of Baghdad (Iraq)

Bull. EGU
Bulletin EGU (Vyzkumny Ustav Energeticky) (Czechoslovakia)

Bull. Eidgenoess. Gesundh., Beil. B
Bulletin des Eidgenoessisches Gesundheitsamtes, Beilage B (Switzerland)

Bull. Environ. Contam. Toxicol.
Bulletin of Environmental Contamination and Toxicology (U.S.-West Germany)

Bull. Exp. Biol. Med. (USSR) (Engl. Transl.)
Bulletin of Experimental Biology and Medicine (USSR) (English Translation of Byulleten Eksperimental'noi Biologii i Meditsiny) (U.S.)

Bull. Ga. Acad. Sci.
Bulletin of the Georgia Academy of Science (U.S.)

Bull. Hist. Dent.
Bulletin of the History of Dentistry (U.S.)

Bull. Inf. A.T.E.N. (Assoc. Tech. Energ. Nucl.)
Bulletin d'Information A.T.E.N. (Association Technique pour l'Energie Nucleaire) (France)

Bull. Inf. A.T.E.N. (Assoc. Tech. Energ. Nucl.), Suppl.
Bulletin d'Information A.T.E.N. (Association Technique pour l'Energie Nucleaire), Supplement (France)

Bull. Inf. Bur. Natl. Metrol.
Bulletin d'Information du Bureau National de Metrologie (France)

Bull. Inf. Sci. Tech. (Paris)
Bulletin d'Information Scientifique et Technique (Paris) (France)

Bull. Inst. Chem. Res., Kyoto Univ.
Bulletin of the Institute for Chemical Research, Kyoto University (Japan)

Bull. Parenter. Drug Assoc.
Bulletin of the Parenteral Drug Association (U.S.)

Bull. Schweiz. Elektrotech. Ver.
Bulletin des Schweizerischen Elektrotechnischen Vereins (Switzerland)

Bull. Sci., Sect. A
Bulletin Scientifique, Section A. Sciences Naturelles, Techniques et Medicales (Yugoslavia)

Bull. Seismol. Soc. Am.
Bulletin of the Seismological Society of America (U.S.)

Bull. Slov. Pol'nohospod. Akad., Vysk. Ustavu Potravin.
Bulletin Slovenskej Pol'nohospodarskej Akademie, Vyskumneho Ustavu Potravinarskeho (Czechoslovakia)

Bull. Soc. Chim. Belg.
Bulletin des Societes Chimiques Belges (Belgium)

Bull. Soc. Chim. Fr.
Bulletin de la Societe Chimique de France (France)

Bull. Soc. Int. Chir.
Bulletin de la Societe Internationale de Chirurgie (Belgium)

Bull. Soc. R. Sci. Liege
Bulletin de la Societe Royale des Sciences de Liege (Belgium)

Bull. Tokyo Inst. Technol. (Engl. Ed.)
Bulletin of the Tokyo Institute of Technology (English Edition) (Not the same publication as Tokyo Kogyo Daigaku Gakuho) (Japan)

Bull. Union Physiciens
Bulletin de l'Union des Physiciens (France)

Bull. Utah Eng. Exp. Stn.
Bulletin of the Utah Engineering Experiment Station (U.S.)

Bundesanzeiger
Bundesanzeiger (West Germany)

Bundesgesetzblatt, Teil 1
Bundesgesetzblatt, Teil 1 (West Germany)

Bundesgesundheitsblatt
Bundesgesundheitsblatt (West Germany)

Bundesrat - Drucksache
Bundesrat - Drucksache (West Germany)

Bunko Kenkyu
Bunko Kenkyu (Journal of the Spectroscopical Society of Japan) (Japan)

Bunseki Kiki
Bunseki Kiki (Analytical Instruments) (Japan)

Byull. Eksp. Biol. Med.
Byulleten Eksperimental'noi Biologii i Meditsiny (U.S.S.R.) For English Translation see Bulletin of Experimental Biology and Medicine (USSR)

C

Cafe, Cacao, The
Cafe, Cacao, The (France)

Cah. Ing. Agron.
Cahiers des Ingenieurs Agronomes (France)

Cah. ORSTOM, Ser. Pedol.
Cahiers ORSTOM, Serie Pedologie (France)

Calcif. Tissue Res.
Calcified Tissue Research (West Germany)

Californium-252 Prog.
Californium-252 Progress (U. S.)

Cancer
Cancer (U.S.)

Cancer Chemother. Rep.
Cancer Chemotherapy Reports (U.S.)

Cancer Res.
Cancer Research (U.S.)

Cancer, Suppl.
Cancer, Supplement (U.S.)

Can. Chem. Process.
Canadian Chemical Processing (Canada)

Can. Entomol.
Canadian Entomologist, The (Canada)

Can. Geophys. Bull.
Canadian Geophysical Bulletin (Canada)

Can. Inst. Food Sci. Technol. J.
Canadian Institute of Food Science and Technology Journal (Canada)
Supersedes Can. Inst. Food Technol. J.

Can. J. Chem.
Canadian Journal of Chemistry (Canada)

Can. J. Chem. Eng.
Canadian Journal of Chemical Engineering (Formerly Canadian Journal of Technology) (Canada)

Can. J. Earth Sci.
Canadian Journal of Earth Sciences (Canada)

Can. J. Microbiol.
Canadian Journal of Microbiology (Canada)

Can. J. Phys.
Canadian Journal of Physics (Canada)

Can. Mach. Metalwork.
Canadian Machinery and Metalworking (Canada)

Can. Med. Assoc. J.
Canadian Medical Association Journal, The (Canada)

Can. Mineral.
Canadian Mineralogist, The (Canada)

Can. Min. J.
Canadian Mining Journal (Incorporates Mining in Canada) (Canada)

Can. Min. Metall. Bull.
Canadian Mining and Metallurgical Bulletin, The (Canada)
Superseded by CIM (Can. Mining Met.) Bull.

Can. Nurse
Canadian Nurse (Canada)

Can. Welder Fabr.
Canadian Welder and Fabricator (Canada)

Carbohydr. Res.
Carbohydrate Research (Netherlands)

Carbon
Carbon (England)

Cardiol. Prat.
Cardiologia Pratica (Italy)

Caries Res.
Caries Research (Switzerland)

Case Stud. At. Phys.
Case Studies in Atomic Physics (Netherlands)

Cas. Lek. Cesk.
Casopis Lekaru Ceskych (Czechoslovakia)

Celestial Mech.
Celestial Mechanics (Netherlands)

Cell Tissue Kinet.
Cell and Tissue Kinetics (England)

Cem. Concr. Res.
Cement and Concrete Research (U.S.)

Cent. Doc. Siderugique, Circ. Inf. Tech.
Centre de Documentation Siderurgique Circulaire d'Information Techniques (France)

Ceram. Crist.
Ceramica y Cristal (Argentina)

CERN Cour.
CERN Courier (Switzerland)

Certif. Eng.
Certified Engineer (South Africa)

Cesk. Cas. Fys.
Ceskoslovensky Casopis pro Fysiku (Czechoslovakia)

Cesk. Fysiol.
Ceskoslovenske Fysiologie (Czechoslovakia)

Cesk. Hyg.
Ceskoslovenska Hygiena (Czechoslovakia)

Cesk. Oftalmol.
Ceskoslovenska Oftalmologie (Czechoslovakia)

Cesk. Otolaryngol.
Ceskoslovenska Otolaryngologie (Czechoslovakia)

Cesk. Radiol.
Ceskoslovenska Radiologie (Formerly Ceskoslovenska Rentgenologie) (Czechoslovakia)

Chagyo Gijutsu Kenkyu
Chagyo Gijutsu Kenkyu (Study of Tea) (Japan)

Chem. Anal. (Warsaw)
Chemia Analityczna (Warsaw) (Poland)

Chem.-Anlagen Verfahren
Chemie-Anlagen und Verfahren (West Germany)

Chem. Ber.
Chemische Berichte (West Germany)

Chem. Br.
Chemistry in Britain (England)

Chem. Can.
Chemistry in Canada (Canada)

Chem. Eng. (London)
Chemical Engineer, The (London) Includes Transaction of the Institution of Chemical Engineers (London) (England)

Chem. Eng. News
Chemical Engineering News (U.S.)

Chem. Eng. Prog.
Chemical Engineering Progress (U.S.)

Chem. Eng. Sci.
Chemical Engineering Science (England)

Chem. Eng. World
Chemical Engineering World (India)

Chem. Geol.
Chemical Geology (Netherlands)

Chem. Ind. (London)
Chemistry and Industry (London) (England)

Chem.-Ing.-Tech.
Chemie-Ingenieur-Technik (West Germany)

Chemistry
Chemistry (U.S.)

Chem. Lab. Betr.
Chemie fuer Labor und Betrieb (West Germany)

Chem. Lett. (Tokyo)
Chemistry Letters (Tokyo) (Japan)

Chem. Listy
Chemicke Listy (Czechoslovakia)

Chem. Pharm. Bull. (Tokyo)
Chemical and Pharmaceutical Bulletin (Tokyo) (Japan)

Chem. Phys. (Amsterdam)
Chemical Physics (Amsterdam) (Netherlands)

Chem. Phys. Lett.
Chemical Physics Letters (Netherlands)

Chem. Phys. Lipids
Chemistry and Physics of Lipids (Netherlands)

Chem. Process. (London)
Chemical Processing (London) (England)
Absorbed Process Technol. Int.

Chem. Prum.
Chemicky Prumysl (Czechoslovakia)

Chem. Scr.
Chemica Scripta (Sweden)
Supersedes Arkiv for Kemi

Chem. Soc. Rev.
Chemical Society Reviews (England) Formed by merger of Quart. Rev., Chem. Soc. and RIC (Roy. Inst. Chem.) Rev.

Chem. Tech. (Leipzig)
Chemische Technik (Leipzig) (East Germany)

Chem.-Ztg., Chem. App.
Chemiker-Zeitung, Chemische Apparatur (West Germany)
Formerly Chem.-Ztg.; changed back to Chem.-Ztg.

Chem. Zvesti
Chemicke Zvesti (Czechoslovakia)

Chest (Chicago)
Chest (Chicago) (U. S.)
Supersedes Diseases of the Chest

Chigaku Kenkyu
Chigaku Kenkyu (Geoscience Studies) (Japan)

Chikyu Kagaku
Chikyu Kagaku (Earth Science) (Japan)

Chimia (Aarau)
Chimia (Aarau) (Switzerland)

Chin. J. Phys. (Peking) (Engl. Transl.)
Chinese Journal of Physics (Peking) (English Translation of Acta Physica Sinica (Wu Li Hsueh Pao)) (U.S.)

Chin. J. Phys. (Taiwan)
Chinese Journal of Physics (Taiwan) (China)

Chishitsu Chosasho Geppo
Chishitsu Chosasho Geppo (Bulletin of the Geological Survey of Japan) (Japan)

Chislennye Metody Mekh. Sploshnoi Sredy
Chislennye Metody Mekhaniki Sploshnoi Sredy (U.S.S.R.)

Chromatographia
Chromatographia (West Germany)

Cienc. Interam.
Ciencia Interamericana (U.S.)

CIM (Can. Min. Metall.) Bull.
CIM (Canadian Mining and Metallurgy) Bulletin (Formerly Canadian Mining and Metallurgy Bulletin) (Canada)

Circulation
Circulation (U.S.)

CIRP, Ann. Int. Inst. Prod. Eng. Res.
CIRP, Annals of the International Institution for Production Engineering Research (England)

Clin. Allergy
Clinical Allergy (England)

Clin. Biochem.
Clinical Biochemistry (Canada)

Clin. Bull.
Clinical Bulletin (U.S.)

Clin. Chem.
Clinical Chemistry (U.S.)

Clin. Chim. Acta
Clinica Chimica Acta (Netherlands)

Clin. Exp. Immunol.
Clinical and Experimental Immunology (England)

Clin. Immunol. Immunopathol.
Clinical Immunology and Immunopathology (U.S.)

Clin. Orthop.
Clinical Orthopaedics (U.S.)
Superseded by Clinical Orthopaedics and Related Research

Coal, Gold Base Miner. South. Afr.
Coal, Gold and Base Minerals of Southern Africa (South Africa)

Coke Chem., USSR (Engl. Transl.)
Coke and Chemistry, USSR (English Translation of Koks Khim.) (England)

Collect. Czech. Chem. Commun.
Collection of Czechoslovak Chemical Communications (Czechoslovakia)

Collect. Phenomena
Collective Phenomena (England)

Combustion
Combustion (U.S.)

Comments Astrophys. Space Phys.
Comments on Astrophysics and Space Physics (England - U. S.)

Comments At. Mol. Phys.
Comments on Atomic and Molecular Physics (England - U. S.)

Comments Nucl. Part. Phys.
Comments on Nuclear and Particle Physics (England - U. S.)

Comments Solid State Phys.
Comments on Solid State Physics (England - U. S.)

Commun. Math. Phys.
Communications in Mathematical Physics (West Germany)

Commun. Pure Appl. Math.
Communications on Pure and Applied Mathematics (U.S.)

Com. Naz. Energ. Nucl., Not.
Comitato Nazionale per l'Energia Nucleare, Notiziario (Italy)

Comp. Biochem. Physiol.
Comparative Biochemistry and Physiology (England)
Divided into parts A and B

Comput. Biomed. Res.
Computers and Biomedical Research (U.S.)

Comput. Phys. Commun.
Computer Physics Communications (Netherlands)

Comput. Programs Biomed.
Computer Programs in Biomedicine (Netherlands)

COMSAT Tech. Rev.
COMSAT (Communications/Satellite Corp.) Technical Review (U.S.)

Contemp. Phys.
Contemporary Physics (England)

Control Instrum.
Control and Instrumentation (Formerly Control and Automation Process) (England)

Copeia
Copeia (U.S.)

Corrosion
Corrosion (U.S.)

Corros. Sci.
Corrosion Science (England)

Cosmic Res. (USSR) (Engl. Transl.)
Cosmic Research (USSR) (English Translation of Kosmicheskie Issledovaniya) (U.S.)

C. R. Acad. Bulg. Sci.
Comptes Rendus de l'Academie Bulgare des Sciences (Bulgaria)

CRC Crit. Rev. Anal. Chem.
CRC Critical Reviews in Analytical Chemistry (U. S.)

CRC Crit. Rev. Clin. Radiol. Nucl. Med.
CRC Critical Reviews in Clinical Radiology and Nuclear Medicine (U.S.)
Supersedes CRC Crit. Rev. Radiol. Sci.

CRC Crit. Rev. Environ. Control
CRC Critical Reviews in Environmental Control (U. S.)

CRC Crit. Rev. Solid State Sci.
CRC Critical Reviews in Solid State Sciences (U. S.)

C. R. Hebd. Seances Acad. Sci.
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences (France)
Divided into Series A, B, C and D

C. R. Hebd. Seances Acad. Sci., Ser. A
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Serie A (France)
Supersedes in part Compt. Rend., Ser. A, B

C. R. Hebd. Seances Acad. Sci., Ser. A, B
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Series A, et B (France)
Series A, B issued separately as Compt. Rend., Ser. A and Compt. Rend., Ser. B; resumed publication as combined volume; paged separately

C. R. Hebd. Seances Acad. Sci., Ser. B
Comptes Rendus Hebdomadaires de Seances de l'Academie des Sciences, Serie B (France)
Supersedes in part Compt. Rend., Ser. A, B; resumed publication as combined volume with Ser. A; paged separately

C. R. Hebd. Seances Acad. Sci., Ser. C
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Serie C (France)

C. R. Hebd. Seances Acad. Sci., Ser. D
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Serie D (France)

C. R. Soc. Biol.
Comptes Rendus des Seances de la Societe de Biologie et de ses Filiales (France)

Croat. Chem. Acta
Croatica Chemica Acta (Yugoslavia)

Cryogenics
Cryogenics (England)

Cryog. Ind. Gases
Cryogenic and Industrial Gases (formerly Cryogenic Engineering News) (U.S.)

Cryog. Technol.
Cryogenic Technology (U.S.)
Superseded by LNG/Cryogenics

Cryst. Lattice Defects
Crystal Lattice Defects (Northern Ireland)

CSIR (Counc. Sci. Ind. Res.) News (India)
CSIR (Council of Scientific and Industrial Research) News (India)

Curr. Sci. (India)
Current Science (India)

Curr. Top. Radiat. Res.
Current Topics in Radiation Research (Netherlands)
Superseded by Curr. Top. Radiat. Res. Quart.

Cytobios
Cytobios (England)

Cytologia (Tokyo)
Cytologia (Tokyo) International Journal of Cytology (Japan)

Czas. Stomatol.
Czasopismo Stomatologiczne (Poland)

CZ-Chem.-Tech.
CZ-Chemie-Technik (Supplement to Chem. Ztg.)
Changed to Chem.-Tech. (Heidelberg); ch

Czech. J. Phys.
Czechoslovak Journal of Physics (Czechoslovakia)

D

Daehan Hwahak Hwoejee
Daehan Hwahak Hwoejee (Journal of the Korean Chemical Society) (South Korea)

Dechema Monogr.
Dechema Monographien (West Germany)

Deep-Sea Res. Oceanogr. Abstr.
Deep-Sea Research and Oceanographic Abstracts (Formerly Deep-Sea Research) (England)

Def. Sci. J. (New Delhi)
Defence Science Journal (New Delhi) (India)

Delft Prog. Rep., Ser. A
Delft Progress Report, Series A. Chemistry and Physics, Chemical and Physical Engineering (Netherlands)
Supersedes in part Delft Prog. Rep., Ser. A-F

Delft Prog. Rep., Ser. B
Delft Progress Report, Series B. Electrical, Electronic and Information Engineering (Netherlands)
Supersedes in part Delft Prog. Rep., Ser. A-F

Dengen Kaihatsu K.K., Chosa Shiryo
Dengen Kaihatsu K.K., Chosa Shiryo (Research Bulletin of Electric Power Development Co., Ltd.) (Japan)

Denki Gakkai Ronbunshi, B
Denki Gakkai Ronbunshi, B (The Transactions of the Institute of Electrical Engineers of Japan, B) (Japan)

Denki Gakkai Ronbunshi, C
Denki Gakkai Ronbunshi, C (The Transactions of the Institute of Electrical Engineers of Japan, C) (Japan)

Denki Gakkai Zasshi
Denki Gakkai Zasshi (The Journal of the Institute of Electrical Engineers of Japan) (Japan)

Denki Kagaku
Denki Kagaku (Journal of the Electrochemical Society of Japan) (Japan)
Changed to Denki Kagaku Oyobi Kogyo Butsuri Kagaku

Denpa Kenkyusho Kiho
Denpa Kenkyusho Kiho (Review of the Radio Research Laboratory) (Japan)

Denryoku Chuo Kenkyusho Gijutsu Daiichi Kenkyusho Hokoku
Denryoku Chuo Kenkyusho Gijutsu Daiichi Kenkyusho Hokoku (Japan)

Denryoku Chuo Kenkyusho Gijutsu Kenkyusho Hokoku
Denryoku Chuo Kenkyusho Gijutsu Kenkyusho Hokoku (Technical Laboratory, Central Research Institute of Electrical Power Industry, Report) (Japan)

Denshi Gijutsu Sogo Kenkyusho Chosa Hokoku
Denshi Gijutsu Sogo Kenkyusho Chosa Hokoku (Japan)

Denshi Gijutsu Sogo Kenkyusho Iho
Denshi Gijutsu Sogo Kenkyusho Iho (Japan)

Denshi Gijutsu Sogo Kenkyusho Kenkyu Hokoku
Denshi Gijutsu Sogo Kenkyusno Kenkyu Hokoku (Research Report of the Electronics General Research Institute) (Japan)

Desalination
Desalination (Netherlands)

Dev. Ind. Sci.
Developpement Industriel et Scientifique (France)

Dev. Med. Child. Neurol.
Developmental Medicine and Child Neurology (England)

DeW Tech. Ber.
DeW Technische Berichte (West Germany)

Diagn. Lab.
Diagnostyka Laboratoryjna (Poland)

Diagn. Plazmy
Diagnostika Plazmy (U.S.S.R.)

Diamond Res.
Diamond Research (England)

Differentiation
Differentiation (England)

Digestion
Digestion (Formerly Gastroenterologia) (Switzerland)

Dis. Colon Rectum
Diseases of the Colon and Rectum (U.S.)

Doboku Gakkaishi
Doboku Gakkaishi (Journal of the Japan Society of Civil Engineers) (Japan)

Dokl. Akad. Nauk Arm. SSR
Doklady Akademii Nauk Armyanskoi SSR (Armenian S.S.R.)

Dokl. Akad. Nauk BSSR
Doklady Akademii Nauk BSSR (Belorussian S.S.R.)

Dokl. Akad. Nauk SSSR
Doklady Akademii Nauk SSSR (U.S.S.R.)
Issued in English Translation by Sections

Dokl. Akad. Nauk SSSR, Ser. Biol.
Doklady Akademii Nauk SSSR, Seriya Biologiya (U.S.S.R.)

Dokl. Akad. Nauk Tadzh. SSR
Doklady Akademii Nauk Tadzhikskoi SSR (Tadzhik S.S.R.)

Dokl. Akad. Nauk Uzb. SSR
Doklady Akademii Nauk Uzbekskoi SSR (Uzbek S.S.R.)

Dokl. Biochem.
Doklady Biochemistry (English Translation of Doklady Akademii Nauk SSSR, Biochemistry Section) (U.S.)

Dokl. Biol. Sci.
Doklady Biological Sciences (English Translation of Dokl. Akad. Nauk SSSR, Biological Sciences Sections) (U.S.)

Dokl. Bot. Sci. (Engl. Transl.)
Doklady Botanical Sciences, (English Translation of Dokl. Akad. Nauk SSSR Botanical Sciences Sections) (U.S.)
Formerly carried as Dokl.-Bot. Sci. Sect. (Engl. Transl.)

Dokl. Chem.
Doklady Chemistry (English Translation of Dokl. Akad. Nauk SSSR, Physical Chemistry Section) (U.S.)

Dokl. Chem. Technol.
Doklady Chemical Technology (English Translation of Doklady Akademii Nauk SSSR, Chemical Technology Section) (U.S.)

Dokl. Phys. Chem.
Doklady Physical Chemistry (English Translation of Dokl. Akad. Nauk SSSR, Physical Chemistry Section) (U.S.)

Dokl. S-kh. Akad., Sofia
Doklady Sel'skokhozyaistvennoi Akademii, Sofia (Bulgaria)

Dokl. TSKhA (Timiryazev. Sel'skokhoz. Akad.)
Doklady TSKhA (Timiryazevskaya Sel'skokhozyaistvennaya Akademiya) (U.S.S.R.)

Dokl. Vses. Akad. S-kh. Nauk
Doklady Vsesoyuznoi Akademii Sel'skokhozyaistvennykh Nauk imeni V. I. Lenina (U.S.S.R.)

Dopov. Akad. Nauk Ukr. RSR, Ser. A
Dopovidi Akademii Nauk Ukrains'koi RSR, Seriya A Fiziko-Tekhnichni ta Matematichni Nauki (Supersedes in Part Dopovidi Akademii Nauk Ukrains'koi RSR) (Ukrainian S.S.R.)

Dopov. Akad. Nauk Ukr. RSR, Ser. B
Dopovidi Akademii Nauk Ukrains'koi RSR, Seriya B Geologiia, Geofizika, Khimiya na Biologiya (Supersedes In Part Dopovidi Akademii Nauk Ukrains'koi RSR) (Ukrainian S.S.R.)

Dornier-Post (Engl. Ed.)
Dornier-Post (English Edition) (West Germany)

Doryokuro Giho
Doryokuro Giho (Japan)

Draht
Draht (West Germany)

Dtsch. Med. Wochenschr.
Deutsche Medizinische Wochenschrift (West Germany)
Issued in English language edition as German Medical Monthly

Dtsch. Zahnaertztl. Z.
Deutsche Zahnaerztliche Zeitschrift (East Germany)

E

Earth Extraterr. Sci.
Earth and Extraterrestrial Sciences (England)

Earth Miner. Sci.
Earth and Mineral Sciences (U.S.)

Earth Planet. Sci. Lett.
Earth and Planetary Science Letters (Netherlands)

Ecol. Monogr.
Ecological Monographs (U.S.)

Ecology
Ecology (U.S.)

Econ. Geol.
Economic Geology and the Bulletin of the Society of Economic Geologists (U.S.)

Ecos
Ecos (Australia)

Educ. Chem.
Education in Chemistry (England)

Egeszsegtudomany
Egeszsegtudomany (Hungary)

Egypt. J. Chem.
Egyptian Journal of Chemistry (Egypt)

Egypt. J. Genet. Cytol.
Egyptian Journal of Genetics and Cytology (Egypt)

Ehara Jiho
Ehara Jiho (Ebara Times) (Japan)

Eisei Kagaku
Eisei Kagaku (The Journal of Hygienic Chemistry) (Japan)

Ekologiya
Ekologiya (U.S.S.R.)

Eksp. Klin. Radiol.
Eksperimental'naya i Klinicheskay a Radiologiya (Ukrainian S.S.R.)
Supersedes Voprosy Eksperimental'noii Klinicheskoi Radiologiia.

Eksp. Med. Morfol.
Eksperimentalna Meditsina i Morfologiya (Bulgaria)

Ekspress-Inf., Montazh Oborudovaniya Teplovykh Elektrostn.
Ekspress-Informatsiya, Montazh Oborudovaniya na Teplovykh Elektrostantsiyakh (U.S.S.R.)

Ekspress-Inf., Ser.: Reg., Razved. Prom. Geofiz.
Ekspress-Informatsiya, Seriya: Regional'naya, Razvedochnaya i Promyslovaya Geofizika (U.S.S.R.)

Ekspress-Inf., Stroit. Tepl. Elektrostn.
Ekspress-Informatsiya, Stroitel'stvo Teplovykh Elektrostantsii (U.S.S.R.)

Ekspress-Inf., Svar. Rab.
Ekspress-Informatsiya, Svarochyne Raboty (U.S.S.R.)

Electricite
Electricite (Belgium)

Electr. Light Power (Boston)
Electric Light and Power (Boston) (U.S.)
Superseded by Electr. Light Power, E/G Ed. and Electr. Light Power, T/D Ed.; reverted to former title

Electrodeposition Surface Treat.
Electrodeposition and Surface Treatment (Switzerland)

Electron Des.
Electronic Design (U.S.)

Electron. Fis. Apl.
Electronica y Fisica Aplicada (Spain)

Electron. Lett.
Electronics Letters (England)

Electron. Power
Electronics and Power (England)

Electrotechniek
Elektrotechniek (Netherlands)

Electr. World
Electrical World (U.S.)

Elektrichestvo
Elektrichestvo (U.S.S.R.)

Elektrie
Elektrie (East Germany)
Supersedes Deut. Elektrotech.

Elektrizitaetswirtschaft
Elektrizitaetswirtschaft (West Germany)

Elektro-Anz.
Elektro-Anzeiger (West Germany)

Elektrokhimiya
Elektrokhimiya (U.S.S.R.)
Issued in English translation as Sov. Electrochem.

Elektron. Datenverarb.
Elektronische Datenverarbeitung (West Germany)
Superseded by Angew. Inform.

Elektronika
Elektronika (Formerly Przeglad Elektroniki) (Poland)

Elektronik (Munich)
Elektronik (Munich) (West Germany)

Elektron. Obrab. Mater.
Elektronnaya Obrabotka Materialov (Moldavian S.S.R.)

Elektroprivreda
Elektroprivreda (Yugoslavia)

Elektrosvyaz
Elektrosvyaz (U.S.S.R.) For English Translation see Telecommunications (USSR) (U.S.)

Elektrotech. Cas.
Elektrotechnicky Casopis (Czechoslovakia)

Elektrotech. Maschinenbau
Elektrotechnik und Maschinenbau (Austria)

Elektrotech. Obz.
Elektrotechniky Obzor (Czechoslovakia)

Elektrotech. Z., A
Elektrotechnische Zeitschrift, A (West Germany)

Elektrotekhnika
Elektrotekhnika (U.S.S.R.)

Elektr. Stn.
Elektricheskie Stantsii (U.S.S.R.)

Elettrotecnica
Elettrotecnica, L' (Italy)

Endocrinol. Exp.
Endocrinologia Experimentalis (Czechoslovakia)

Endocrinol. Jpn.
Endocrinologia Japonica (Japan)

Endocrinology
Endocrinology (U.S.)

Endokrinol. Pol.
Endokrynologia Polska (Poland)

Energ. Atomtech.
Energia es Atomtechnika (Hungary)

Energetika
Energetika (Czechoslovakia)

Energetyka
Energetyka (Poland)

Energie
Energie (West Germany)

Energies
Energies (France)

Energiewirtsch. Tagesfragen
Energiewirtschaftliche Tagesfragen (West Germany)

Energ. Nucl. (Madrid)
Energia Nuclear (Madrid) (Spain)

Energ. Nucl. (Milan)
Energia Nucleare (Milan) (Italy)

Energ. Stroit.
Energeticheskoe Stroitel'stvo (U.S.S.R.)

Energ. Stroit. Rubezhom
Energeticheskoe Stroitel'stvo za Rubezhom (Supplement to Energ. Stroit.) (U.S.S.R.)

Energ. Tech.
Energie und Technik (West Germany)

Energy Dig.
Energy Digest (incorporating The Journal of Fuel and Heat Technology; and Fuel Efficiency) (England)

Energy Sources
Energy Sources (U.S.)

Energy World
Energy World (England)
Supersedes in part J. Inst. Fuel

Eng. Dig. (Toronto)
Engineering Digest (Toronto) (Canada)

Engei Gakkai Zasshi
Engei Gakkai Zasshi (Journal of the Japanese Society for Horticultural Science) (Japan)

Eng. Fract. Mech.
Engineering Fracture Mechanics (England)

Engineer
Engineer, The (England)

Eng. J. (Montreal)
Engineering Journal, The (Montreal) (Canada)

Eng. Min. J.
Engineering and Mining Journal (U.S.)

Eng. Times (Calcutta)
Engineering Times (Calcutta) (India)

Entomol. Exp. Appl.
Entomologia Experimentalis et Applicata (Netherlands)

Environ. Change
Environment and Change (England)
Ceased publication

Environ. Geol.
Environmental Geology (U.S.)

Environ. Physiol. Biochem.
Environmental Physiology and Biochemistry (Denmark)
Supersedes Environ. Physiol.

Environ. Res.
Environmental Research (U.S.)

Environ. Sci. Technol.
Environmental Science and Technology (U. S.)

Enzyme
Enzyme (Switzerland)
Supersedes Enzymol. Biol. Clin.

Epidemiol., Mikrobiol. Infekts. Boles.
Epidemiologiya, Mikrobiologiya i Infektsiozni Bolesti (Bulgaria)

Erdoel Kohle, Erdgas, Petrochem.
Erdoel und Kohle, Erdgas, Petrochemie (West Germany)
Superseded by Erdoel Kohle, Erdgas, Petrochem. Brennst.-Chem.

Erfahrungsheilkunde
Erfahrungsheilkunde (West Germany)

Erzmetall
Erzmetall (West Germany)
Supersedes Z. Erzbergbau Metallhuettenw.

EULEP Newsl.
EULEP (European Late Effects Project Group) Newsletter (Belgium)

Euphytica
Euphytica. Netherlands Journal of Plant Breeding (Netherlands)

Eur. J. Biochem.
European Journal of Biochemistry (Formerly Biochemische Zeitschrift) (West Germany)

Eur. J. Cancer
European Journal of Cancer (England)

Eur. J. Clin. Invest.
European Journal of Clinical Investigation (West Germany)
Supersedes Archiv fuer Klinische Medizin

Eur. J. Immunol.
European Journal of Immunology (West Germany)

Eur. J. Obstet., Gynecol. Reprod. Biol.
European Journal of Obstetrics, Gynecology and Reproductive Biology (Netherlands)

Eur. Surg. Res.
European Surgical Research (Switzerland)

Exp. Cell Res.
Experimental Cell Research (U.S.)

Experientia
Experientia (Switzerland)

Exp. Eye Res.
Experimental Eye Research (England)

Exp. Hematol.
Experimental Hematology (Denmark)

Exp. Mech.
Experimental Mechanics (U.S.)

Exp. Parasitol.
Experimental Parasitology (U.S.)

Exp. Pathol.
Experimentelle Pathologie (East Germany)

Exp. Tech. Phys.
Experimentelle Technik der Physik (East Germany)

F

FAPIG (Tokyo)
FAPIG (Tokyo) (Japan)

Farbe Lack
Farbe und Lack (West Germany)

Farmakol. Toksikol.
Farmakologiya i Toksikologiya (U.S.S.R.) Issued in English Translation as Pharmacology and Toxicology (USSR)

Farm J. (Calcutta)
Farm Journal (Calcutta) (India)

Farm. Obz.
Farmaceuticky Obzor (Czechoslovakia)

Farm. Pol.
Farmacja Polska (Poland)

Faserforsch. Textiltech.
Faserforschung und Textiltechnik (East Germany)

FEBS (Fed. Eur. Biochem. Soc.) Lett.
FEBS (Federation of European Biochemical Societies) Letters (Netherlands)

Fed. Proc.
Federation Proceedings (U.S.)

Fernelde-Praxis
Fernelde-Praxis (West Germany)

Ferroelectrics
Ferroelectrics (England)

Fields Quanta
Fields and Quanta (England)

Finommech.-Mikrotech.
Finommechanika-Mikrotechnika (Hungary)
Supersedes Finommechanik

Fish. Bull.
Fishery Bulletin (U.S.)

Fisken Havet
Fisken og Havet (Norway)

Fiz. Elektron.
Fizicheskaya Elektronika (U.S.S.R.)

Fizika, Suppl. (Zagreb)
Fizika, Supplement (Zagreb) (Yugoslavia)

Fizika (Zagreb)
Fizika (Zagreb) (Yugoslavia)

Fiziol. Fiz.-Khim. Mekh. Regul. Obmennykh Protsessov Org.
Fiziologicheskie i Fiziko-Khimicheskie Mekhanizmy Regulyatsii Obmennykh Protsessov Organizma (U.S.S.R.)

Fiziol. Zh., Akad. Nauk Ukr. RSR
Fiziologichnii Zhurnal, Akademiya Nauk Ukrainskoi RSR (Ukrainian S.S.R.)

Fiziol. Zh. SSSR
Fiziologicheskii Zhurnal SSSR imeni I. M. Sechenova (U.S.S.R.)

Fiz.-Khim. Mekh. Mater.
Fiziko-Khimicheskaya Mekhanika Materialov (Ukrainian S.S.R.)
Issued in English translation as Soviet Materials Science

Fiz. Khim. Obrab. Mater.
Fizika i Khimiya Obrabotki Materialov (U.S.S.R.)

Fiz. Met. Metalloved.
Fizika Metallov i Metallovedeniya, Akademiya Nauk SSSR, Ural'skii Filial (U.S.S.R.) For English Translation see The Physics of Metals and Metallography (USSR)

Fiz. Plazmy Probl. Upr. Termoyad. Sin.
Fizika Plazmy i Problemy Upravlyaemogo Termoyadernogo Sinteza (Ukrainian S.S.R.)

Fiz. Sz.
Fizikai Szemle (Hungary)

Fiz. Tekh. Poluprov.
Fizika i Tekhnika Poluprovodnikov (U.S.S.R.)
Issued in English Translation as Soviet Physics-Semiconductors

Fleischwirtschaft
Fleischwirtschaft, Die (West Germany)

Fluid Dyn. (USSR) (Engl. Transl.)
Fluid Dynamics (USSR) (English Translation of Izvestiya Akademii Nauk SSSR, Mekhanika Zhidkosti i Gaza) (U.S.)

Fogorv. Sz.
Fogorvosi Szemle (Hungary)

Folia Biol. (Krakow)
Folia Biologica (Krakow) (Poland)

Folia Biol. (Prague)
Folia Biologica (Prague) (Czechoslovakia)

Folia Histochem. Cytochem. (Krakow)
Folia Histochemica et Cytochemica (Krakow) (Poland)

Folia Med. (Plovdiv)
Folia Medica (Plovdiv) (Bulgaria)

Folia Microbiol. (Prague)
Folia Microbiologica (Prague) (Czechoslovakia)

Folia Morphol. (Prague)
Folia Morphologica (Prague) (Czechoslovakia)

Fonderie
Fonderie (France)

Food Irradiat. Inf.
Food Irradiation Information (West Germany)

Forsch. Geb. Ingenieurwes.
Forschung auf dem Gebiete des Ingenieurwesens (West Germany)

Fortschr. Chem. Forsch.
Fortschritte der Chemischen Forschung (West Germany)

Fortschr. Geb. Roentgenstr. Nuklearmed.
Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin (West Germany)

Fortschr. Phys.
Fortschritte der Physik (East Germany)

Fortune
Fortune (U.S.)

Forum (Chicago)
Forum, The (Chicago) (U.S.)

Found. Phys.
Foundations of Physics (U.S.)

Foundry Manage. Technol.
Foundry Management and Technology (U.S.)

Fra Fys. Verden
Fra Fysikkens Verden (Norway)

Fridericiana
Fridericiana (West Germany)

Front. Radiat. Ther. Oncol.
Frontiers of Radiation Therapy and Oncology (Switzerland)

Fuel
Fuel. A Journal of Fuel Science (England)

Fuji Jiho
Fuji Jiho (The Fuji Electric Journal) (Japan)

Fukui Daigaku Kogakubu Kenkyu Hokoku
Fukui Daigaku Kogakubu Kenkyu Hokoku (Memoirs of the Faculty of Engineering, Fukui University) (Japan)

Fundam. Cosmic Phys.
Fundamentals of Cosmic Physics (England)

Funk-Tech.
Funk-Technik (West Germany)

Furukawa Denko Jiho
Furukawa Denko Jiho (Furukawa Electric Review) (Japan)

Fys. Tidsskr.
Fysisk Tidsskrift (Denmark)

G

Gac. Med. Mex.
Gaceta Medica de Mexico (Mexico)

Galvano-Organo
Galvano-Organo (France)
Supersedes Galvano

Galvanotechnik
Galvanotechnik (West Germany)

Gamma Field Symp.
Gamma Field Symposia, Ibaraki (Japan)

Ganita
Ganita (India)

Gann
Gann (Japan)

Gan No Rinsho
Gan No Rinsho (Japanese Journal of Cancer Clinics) (Japan)

Ganseki Kobutsu Kosho Gakkaishi
Ganseki Kobutsu Kosho Gakkaishi (The Journal of the Japanese Association of Mineralogists, Petrologists and Economic Geologists) (Japan)

Gartenbauwissenschaft
Gartenbauwissenschaft (West Germany)

Gas- Wasserfach, Gas-Erdgas
Gas- und Wasserfach, Gas-Erdgas (West Germany)
Continues in part Gas- Wasserfach

Gas- Wasserfach, Wasser - Abwasser
Gas- und Wasserfach, Wasser - Abwasser (West Germany)
Continues in part Gas- und Wasserfach, Das

Gaz. Cukrow.
Gazeta Cukrownicza (Poland)

G. Batteriol., Virol., Immunol. Ann. Osp Maria Vittoria Torino
Giornale di Batteriologia, Virologia, ed Immunologia ed Annali dell'Ospedale Maria Vittoria di Torino (Italy)

Gemeinsames Ministerialbl., A
Gemeinsames Ministerialblatt, A (West Germany)

Genet. Agrar.
Genetica Agraria (Italy)

Genetics
Genetics (U.S.)

Genetics, Suppl.
Genetics, Supplement (U.S.)

Genetika
Genetika (U.S.S.R.)
Issued in English Translation as Soviet Genetics

Genet. Pol.
Genetica Polonica (Poland)

Genet. Res.
Genetical Research (England)

Genet. Selek.
Genetika i Selektsiya (Bulgaria)

Genet. Slechteni
Genetika a Slechteni (Czechoslovakia)

Gen. Relativ. Gravitation
General Relativity and Gravitation (England)

Genshiryoku Chosa Jiho
Genshiryoku Chosa Jiho (Review of Atomic Industries) (Japan)

Genshiryoku Iinkai Geppo
Genshiryoku Iinkai Geppo (Journal of Atomic Energy Commission) (Japan)

Genshiryoku Kogyo
Genshiryoku Kogyo (Nuclear Engineering) (Japan)

Geochem. J. (Nagoya)
Geochemical Journal (Nagoya) (Japan)

Geochim. Cosmochim. Acta
Geochimica et Cosmochimica Acta (England)

Geochimica (Engl. Transl.)
Geochimica (English Translation of Ti Ch'iu Hua-Hsueh) (U.S.)

Geofiz. App.
Geofizicheskaya Apparatura (U.S.S.R.)

Geofiz. Sb.
Geofizicheskii Sbornik (Ukrainian S.S.R.)

Geofiz. Sb., Akad. Nauk Ukr. SSR, Inst. Geofiz.
Geofizicheskii Sbornik, Akademiya Nauk Ukrainskoi SSR, Institut Geofiziki (Ukrainian S.S.R.)

Geokhimiya
Geokhimiya (U.S.S.R.)
Selected Articles Appear in English Translation in Geochemistry International

Geol. Foeren. Stockh. Foerh.
Geologiska Foreningens i Stockholm Forhandlingar (Sweden)

Geol. Geofiz.
Geologiya i Geofizika (U.S.S.R.)

Geol. Jahrb., Reihe C
Geologisches Jahrbuch, Reihe C. Hydrogeologie, Ingenieurgeologie (West Germany)
Supersedes in part Geol. Jahrb.

Geol. Mijnbouw
Geologie en Mijnbouw (Netherlands)

Geol. Pruzkum
Geologicky Pruzkum (Czechoslovakia)

Geol. Rud. Mestorozhd.
Geologiya Rudnykh Mestorozhdenii, Akademiya Nauk SSSR (U.S.S.R.)

Geol. Rundsch.
Geologische Rundschau (West Germany)

Geol. Zh. (Russ. Ed.)
Geologicheskii Zhurnal (Russian Edition) (Ukrainian S.S.R.)

Geomagn. Aeron. (USSR) (Engl. Transl.)
Geomagnetism and Aeronomy (USSR) (English Translation of Geomagnetizm i Aeronomiya) (U.S.)

Geophys. J. R. Astron. Soc.
Geophysical Journal of The Royal Astronomical Society (England)

Geophys. Norv.
Geophysica Norvegica (Norway)

Geophys. Res. Lett.
Geophysical Research Letters (U.S.)
Supersedes ''Letters'' Section of J. Geophys. Res.

Gerlands Beitr. Geophys.
Gerlands Beitraege zur Geophysik (Formerly carried as Beitraege zur Geophysik, Gerlands) (East Germany)

Gerontologia
Gerontologia (Switzerland)

G. Fis. Sanit. Prot. Radiaz.
Giornale di Fisica Sanitaria e Protezione Contro le Radiazioni (Italy)

Gidrobiol. Zh.
Gidrobiologicheskii Zhurnal (Ukrainian S.S.R.)

Gig. Sanit.
Gigiena i Sanitariya (U.S.S.R.) Issued in English Translation as Hygiene and Sanitation (USSR)

Gig. Tr. Prof. Zabol.
Gigiena Truda i Professional'nye Zabolevaniya (U.S.S.R.)

Ginecol. Obstet. Mex.
Ginecologia y Obstetricia de Mexico (Mexico)

Ginekol. Pol.
Ginekologia Polska (Poland)

G-I-T (Glas- Instrum.-Tech.) Fachz. Lab.
G-I-T (Glas- und Instrumenten-Technik) Fachzietschrift fuer das Laboratorium (West Germany)

GKSS-Informationen
GKSS-Informationen (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H. (West Germany)

Glastech. Ber.
Glastechnische Berichte (West Germany)

Glueckauf
Glueckauf (West Germany)

Glueckauf-Forschungsh.
Glueckauf-Forschungshefte (West Germany)

God. Sofii. Univ., Biol. Fak.
Godishnik na Sofiiskiya Universitet, Biologicheski Fakultet (Bulgaria)

God. Sofii. Univ., Fiz. Fak.
Godishnik na Sofiiskiya Universitet, Fizicheski Fakultet (Bulgaria)

God. Vissh. Tekh. Uchebni. Zaved., Fiz.
Godishnik na Visshite Tekhnicheski Uchebni Zavedeniya, Fizika (Bulgaria)

Gold Bull.
Gold Bulletin (South Africa)

Gradinar. Lozar. Nauka
Gradinarska i Lozarska Nauka (Yugoslavia)

Ground Water
Ground Water (U. S.)

Growth
Growth (U.S.)

Gut
Gut (British Society of Gastroenterology) (England)

H

Haematologica (Pavia)
Haematologica (Pavia) (Italy)

Haerterei-Tech. Mitt.
Haerterei-Technische Mitteilungen (West Germany)

Haikan Gijutsu
Haikan Gijutsu (The Piping Engineering) (Japan)

Handelsblatt
Handelsblatt (West Germany)

Health Phys.
Health Physics (England)

Heat. Air Cond. J.
Heating and Air Conditioning Journal, The (England) Incorporating The Steam and Heating Engineer, The Steam Engineer, Heating and The Industrial Heating Engineering

Heat Eng. (Livingston, N. J.)
Heat Engineering (Livingston, New Jersey) (U.S.)

Heat., Piping Air Cond.
Heating, Piping and Air Conditioning (U.S.)

Heat Transfer - Jpn. Res.
Heat Transfer - Japanese Research (U.S.)

Heat Transfer - Sov. Res.
Heat Transfer - Soviet Research (U.S.)

Helv. Chim. Acta
Helvetica Chimica Acta (Switzerland)

Helv. Chir. Acta
Helvetica Chirurgica Acta (Switzerland)

Helv. Phys. Acta
Helvetica Physica Acta (Switzerland)

Herpetologica
Herpetologica (U.S.)

High Energy Chem. (USSR) (Engl. Transl.)
High Energy Chemistry (USSR) (English Translation of Khimiya Vysokikh Energiya) (U. S.)

High Temp. - High Pressures
High Temperatures - High Pressures. International Journal of Research (England)

High Temp. Sci.
High Temperature Science. An International Journal (U.S. - England)

High Temp. (USSR) (Engl. Transl.)
High Temperature (USSR) (English Translation of Teplofizika Vysokikh Temperatur) (U. S.)

Hihakai Kensa
Hihakai Kensa (Journal of NDI) (Japan)

Himeji Kogyo Daigaku Kenkyu Hokoku
Himeji Kogyo Daigaku Kenkyu Hokoku (Reports of the Himeji Inst. of Technology) (Japan)

Hinyokika Kiyo
Hinyokika Kiyo (Acta Urologica Japonica) (Japan)

Hirosaki Igaku
Hirosaki Igaku (Hirosaki Medical Journal) (Japan)

Hiroshima Daigaku Genbaku Hoshano Igaku Kenkyusho Nenpo
Hiroshima Daigaku Genbaku Hoshano Igaku Kenkyusho Nenpo (Proceedings of the Research Institute for Nuclear Medicine and Biology, Hiroshima University) (Japan)

Hiroshima Igaku
Hiroshima Igaku (Journal of the Hiroshima Medical Association) (Japan)

Hiroshima Nogyo Tanki Daigaku Kenkyu Hokoku
Hiroshima Nogyo Tanki Daigaku Kenkyu Hokoku (Bulletin of the Hiroshima Agricultural College) (Japan)

Histochemie
Histochemie (West Germany)
Changed to Histochemistry

Histochemistry
Histochemistry (West Germany)
Supersedes Histochemie

Hitachi Hyoron
Hitachi Hyoron (The Hitachi Review) (Japan)

Hitachi Zosen Giho
Hitachi Zosen Giho (The Hitachi Zosen Technical Review) (Japan)

Hodowla Rosl., Aklim. Nasienn.
Hodowla Roslin, Aklimatyzacja i Nasiennictwo (Poland)

Hoken Butsuri
Hoken Butsuri (Journal of Japan Health Physics Society) (Japan)

Hokkaido Daigaku Kogakubu Kenkyu Hokoku
Hokkaido Daigaku Kogakubu Kenkyu Hokoku (Bulletin of the Faculty of Engineering, Hokkaido University) (Japan)

Honvedorvos
Honvedorvos (Hungary)

Horm. Metab. Res.
Hormone and Metabolic Research (West Germany)

Hoshasen Ikushujo Kenkyu Hokoku
Hoshasen Ikushujo Kenkyu Hokoku (Japan)

Hoshasen Kagaku
Hoshasen Kagaku (Japan)

Hua Hseuh Tung Pao
Hua Hseuh Tung Pao (Chemical Bulletin) (China)
Ceased Publication

Humangenetik
Humangenetik (West Germany)

Hutn. Listy
Hutnicke Listy (Czechoslovakia)

Hydrobiologia
Hydrobiologia (Netherlands)

Hydrol. Sci. Bull.
Hydrological Sciences Bulletin/Bulletin des Sciences Hydrologiques (England)

I

IBM Tech. Disclosure Bull.
IBM Technical Disclosure Bulletin (U. S.)

I-ch'uan-hsueh T'ung-hsun
I-ch'uan-hsueh T'ung-hsun (Bulletin of Genetics) (China)

IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.
IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics (U.S.)

IEEE (Inst. Electr. Electron. Eng.) J. Solid-State Circuits
IEEE (Institute of Electrical and Electronics Engineers) Journal of Solid State Circuits (U.S.)

IEEE (Inst. Electr. Electron. Eng.) Spectrum
IEEE (Institute of Electrical and Electronics Engineers) Spectrum (U.S.)

IEEE (Inst. Electr. Electron. Eng.) Trans. Aerosp. Electron. Syst.
IEEE (Institute of Electrical and Electronics Engineers) Transactions on Aerospace and Electronics Systems (U.S.)

IEEE (Inst. Electr. Electron. Eng.) Trans. Antennas Propag.
IEEE (Institute of Electrical and Electronics Engineers) Transactions on Antennas and Propagation (U.S.)

IEEE (Inst. Electr. Electron. Eng.) Trans. Electron Devices
IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices (U.S.)

IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.
IEEE (Institute of Electrical and Electronics Engineers), Transactions on Magnetics (U.S.)

IEEE (Inst. Electr. Electron. Eng.) Trans. Microwave Theory Tech.
IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques (U.S.)

IEEE (Inst. Electr. Electron. Eng.) Trans. Nucl. Sci.
IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (Formerly IRE (Institute of Radio Engineers) Transactions on Nuclear Science) (U.S.)

IEEE (Inst. Electr. Electron. Eng.) Trans. Plasma Sci.
IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (U.S.)

IEEE (Inst. Electr. Electron. Eng.) Trans. Power Appar. Syst.
IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems (U.S.)

Igaku No Ayumi
Igaku No Ayumi (Progress in Medicine) (Japan)

Igiena (Bucharest)
Igiena (Bucharest) (Romania)

Ig. Sanita Pubblica
Igiene e Sanita Pubblica (Italy)

Immunology
Immunology (England)

Impuls
Impuls. Zeitschrift des Industriezweiges Automatisierungsgeraete (East Germany)

Incompat. Newsl.
Incompatibility Newsletter (Netherlands)

Ind. Aliment. Agric. (Paris)
Industries Alimentaires et Agricoles (Paris) (France)

Ind.-Anz.
Industrie-Anzeiger (West Germany)

Ind. At. Spat.
Industries Atomiques et Spatiales (France)
Supersedes Ind. At. and Sci. Ind. Spat., beginning Jan. 1972

Ind. Conserve
Industria Conserve (Italy)

Ind. Eng. Chem., Fundam.
Industrial and Engineering Chemistry, Fundamentals (U.S.)

Ind. Eng. Chem., Prod. Res. Dev.
Industrial and Engineering Chemistry, Product Research and Development (U.S.)

Ind. Heat.
Industrial Heating (U.S.)

Indian J. Agric. Chem.
Indian Journal of Agricultural Chemistry (India)

Indian J. Agric. Res.
Indian Journal of Agricultural Research (India)

Indian J. Agric. Sci.
Indian Journal of Agricultural Science, The (India)

Indian J. Appl. Chem.
Indian Journal of Applied Chemistry (India)

Indian J. Biochem. Biophys.
Indian Journal of Biochemistry and Biophysics (India)
Continues Indian J. Biochem.

Indian J. Cancer
Indian Journal of Cancer (India)

Indian J. Chem.
Indian Journal of Chemistry (India)

Indian J. Exp. Biol.
Indian Journal of Experimental Biology (India)

Indian J. Genet. Plant Breed.
Indian Journal of Genetics and Plant Breeding (India)

Indian J. Hered.
Indian Journal of Heredity (India)

Indian J. Med. Res.
Indian Journal of Medical Research, The (India)

Indian J. Phys.
Indian Journal of Physics and Proceedings of The Indian Association for the Cultivation of Science (India)

Indian J. Pure Appl. Math.
Indian Journal of Pure and Applied Mathematics (India)

Indian J. Pure Appl. Phys.
Indian Journal of Pure and Applied Physics (India)

Indian J. Radiol.
Indian Journal of Radiology (India)

Indian J. Radio Space Phys.
Indian Journal of Radio and Space Physics (India)

Indian J. Technol.
Indian Journal of Technology (Formerly Journal of Scientific and Industrial Research (India), Section D) (India)

Indian J. Theor. Phys.
Indian Journal of Theoretical Physics (India)

Indian Min. Eng. J.
Indian Mining and Engineering Journal (India)

Indian Soc. Nucl. Tech. Agric. Biol., Newsl.
Indian Society for Nuclear Techniques in Agriculture and Biology, Newsletter (India)

Ind. Lab. (USSR) (Engl. Transl.)
Industrial Laboratory (USSR) (English Translation of Zavodskaya Laboratoriya) (U.S.)

Ind. Saf. Chron.
Industrial Safety Chronicle (India)

Inf. Byull. Sov. Antarkt. Eksped.
Informatsionnyi Byulleten Sovetskoi Antarkticheskoi Ekspeditsii (U.S.S.R.)

Infect. Immun.
Infection and Immunity (U. S.)

Infrared Phys.
Infrared Physics. An International Research Journal (England)

Ing. Ambientale
Ingegneria Ambientale (Italy)

Ingegneria
Ingegneria (Italy)

Ingenieursblad
Ingenieursblad (Belgium)

Ingenieur (The Hague)
Ingenieur (The Hague) (Netherlands)

Ingenioer-nytt
Ingenioer-nytt (Norway)

Ing. Ind.
Ingenieria e Industria (Argentina)

Ing. Nucl.
Ingegneria Nucleare (Italy)

Inorg. Chem.
Inorganic Chemistry (U.S.)

Inorg. Chim. Acta
Inorganica Chimica Acta (Switzerland)

Inorg. Mater. (USSR) (Engl. Transl.)
Inorganic Materials (USSR) (English Translation of Izvestiya Akademii Nauk SSSR, Neorganicheskie Materialy) (U.S.)

Inorg. Nucl. Chem. Lett.
Inorganic and Nuclear Chemistry Letters (England-U.S.)

Inquinamento
Inquinamento (Italy)

Inst. Min. Metall., Trans. Sect. C
Institution of Mining and Metallurgy, Transactions, Section C. Mineral Processing and Extractive Metallurgy (England)
Continues in part Trans. Inst. Mining Met.

Instrum. Exp. Tech. (USSR) (Engl. Transl.)
Instruments and Experimental Techniques (USSR) (English Translation of Pribory i Tekhnika Eksperimenta) (U.S.)

Instrum. Technol.
Instrumentation Technology (Formerly ISA (Instrument Society of America) Journal) (U.S.)

Int. At. Energy Agency Bull.
International Atomic Energy Agency Bulletin (Austria)

Int. Biodeterior. Bull.
International Biodeterioration Bulletin (England)

Int. Elektron. Rundsch.
Internationale Elektronische Rundschau (Germany)

Interavia
Interavia (Switzerland)

Internist
Internist, Der (West Germany)

Int. J. Appl. Radiat. Isot.
International Journal of Applied Radiation and Isotopes (England)

Int. J. Chem. Kinet.
International Journal of Chemical Kinetics (U. S.)

Int. J. Control
International Journal of Control (England)

Int. J. Electron.
International Journal of Electronics (Formerly Journal of Electronics and Control) (England)

Int. J. Environ. Stud.
International Journal of Environmental Studies, The (England)

Int. J. Fract.
International Journal of Fracture (Netherlands)
Supersedes International Journal of Fracture Mechanics

Int. J. Heat Mass Transfer
International Journal of Heat and Mass Transfer (England)

Int. J. Magn.
International Journal of Magnetism (England - U. S.)

Int. J. Mass Spectrom. Ion Phys.
International Journal of Mass Spectrometry and Ion Physics (Netherlands) (Formerly carried as J. Mass Spectrom. Ion Phys.)

Int. J. Nucl. Med. Biol.
International Journal of Nuclear Medicine and Biology (England)

Int. J. Oral Surg.
International Journal of Oral Surgery (Denmark)

Int. J. Parasitol.
International Journal for Parasitology (England)

Int. J. Powder Metall. Powder Technol.
International Journal of Powder Metallurgy and Powder Technology (U.S.)
Supersedes Int. J. Powder Met.

Int. J. Pressure Vessels Piping
International Journal of Pressure Vessels and Piping (England)

Int. J. Quant. Chem.
International Journal of Quantum Chemistry (U.S.)

Int. J. Quant. Chem., Symp.
International Journal of Quantum Chemistry, Symposium (U.S.)

Int. J. Radiat. Biol.
International Journal of Radiation Biology and Related Studies in Physics, Chemistry and Medicine (England)

Int. J. Radiat. Eng.
International Journal of Radiation Engineering (Israel)

Int. J. Radiat. Phys. Chem.
International Journal for Radiation Physics and Chemistry (England)

Int. J. Rock Mech. Min. Sci.
International Journal of Rock Mechanics and Mining Sciences (U.S. - England)

Int. J. Theor. Phys.
International Journal of Theoretical Physics (England)

Int. J. Vitam. Nutr. Res.
International Journal for Vitamin and Nutrition Research (Switzerland)
Supersedes Int. Z. Vitaminforsch.

Int. Metall. Rev.
International Metallurgical Reviews (England)
Supersedes Met. Rev.

Int. Surg.
International Surgery (U.S.)

Int. Urol. Nephrol.
International Urology and Nephrology (Hungary)

Invest. Radiol.
Investigative Radiology (U.S.)

In Vitro
In Vitro (U.S.)

Inzh.-Fiz. Zh.
Inzhenerno-Fizicheskii Zhurnal (Formerly Inzhenerno-Fizicheskii Zhurnal, Akademii Nauk Belorusskoi SSR) (Belorussian S.S.R.)

Ion Exch. Membranes
Ion Exchange and Membranes (England)

IRS Kurz-Inf., Reihe A
IRS Kurz-Information, Reihe A (West Germany)

IRS Kurz-Inf., Reihe C
IRS Kurz-Information, Reihe C (West Germany)

IRS Mitt.
IRS (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine) Mitteilungen (West Germany)

Iryo
Iryo (Medical Treatment) (Japan)

Ishikawajima-Harima Giho
Ishikawajima-Harima Giho (Ishikawajima-Harima Engineering Review) (Japan)

Isotopenpraxis
Isotopenpraxis (East Germany)

Isr. J. Chem.
Israel Journal of Chemistry (Supersedes Bulletin of the Research Council of Israel, Section A Chemistry) (Israel)

Isr. J. Med. Sci.
Israel Journal of Medical Sciences (Israel)

Isr. J. Technol.
Israel Journal of Technology (Israel)

Istanbul Univ. Fen Fak. Mecm., Seri A
Istanbul Universitesi Fen Fakultesi Mecmuasi, Seri A (Turkey)

Istanbul Univ. Fen Fak. Mecm., Seri B
Istanbul Universitesi Fen Fakultesi Mecmuasi, Seri B (Turkey)

Itogi Nauki Tekh., Metallored. Term. Obrab.
Itogi Nauki i Tekhniki, Metallovedenie i Termicheskaya Obrabotka (U.S.S.R.)

Iyo Denshi To Seitai Kogaku
Iyo Denshi To Seitai Kogaku (Nippon M-E Gakkai Zasshi) (Japanese Journal of Medical Electronics and Biological Engineering) (Japan)

Izotoptechnika
Izotoptechnika (Hungary)
Supersedes Atomtech. Tajek.

Izotopy SSSR
Izotopy v SSSR (U.S.S.R.)

Izv. Akad. Nauk Arm. SSR, Ser. Fiz.
Izvestiya Akademii Nauk Armyanskoi SSR, Seriya Fizika (Formerly part of Izvestiya Akademii Nauk Armyanskoi SSR, Seriya Fiziko-Matematicheskikh Nauk) (Armenian S.S.R.)

Izv. Akad. Nauk Arm. SSR, Ser. Mekh.
Izvestiya Akademii Nauk Armyanskoi SSR, Seriya Mekhanika (Formerly a Part of Izvestiya Akademii Nauk Armyanskoi SSR, Seriya Fiziko-Matematicheskikh Nauk) (Armenian S.S.R.)

Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.-Tekh. Mat. Nauk
Izvestiya Akademii Nauk Azerbaidzhanskoi SSR, Seriya Fiziko- Tekhnicheskikh i Matematicheskikh Nauk (Azerbaidzhan S.S.R.)

Izv. Akad. Nauk Est. SSR, Fiz. Mat.
Izvestiya Akademii Nauk Estonskoi SSR, Fizika Matematika (Estonian S.S.R.) (Formerly a Part of Izvestiya Akademii Nauk Estonskoi SSR, Seriya Fiziko-Matematicheskikh i Tekhnicheskikh Nauk) (Estonian S.S.R.)

Izv. Akad. Nauk Est. SSR, Khim. Geol.
Izvestiya Akademii Nauk Estonskoi SSR, Khimiya Geologiya (Estonian S.S.R.) (Formerly a Part of Izvestiya Akademii Nauk Estonskoi SSR, Seriya Fiziko-Matematicheskikh i Tekhnicheskikh Nauk) (Estonian S.S.R.)

Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.
Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Fiziko-Matematicheskaya (Formerly Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Fiziko-Matematicheskikh Nauk) (Kazakh S.S.R.)

Izv. Akad. Nauk SSSR, Energ. Transp.
Izvestiya Akademii Nauk SSSR, Energetika i Transport (U.S.S.R.)

Izv. Akad. Nauk SSSR, Met.
Izvestiya Akademiya Nauk SSSR, Metally (Formerly Izvestiya Akademiya Nauk SSSR, Metallurgiya, Gornoe Delo) (U.S.S.R.)
Issued in English Translation as Russian Metallurgy

Izv. Akad. Nauk SSSR, Neorg. Mater.
Izvestiya Akademii Nauk SSSR, Neorganicheskie Materialy (U.S.S.R.) Issued in English Translation as Inorganic Materials (USSR)

Izv. Akad. Nauk SSSR, Ser. Biol.
Izvestiya Akademii Nauk SSSR, Seriya Biologicheskaya (U.S.S.R.)

Izv. Akad. Nauk SSSR, Ser. Fiz.
Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya (U.S.S.R.)
Issued in English Translation as Bull. Acad. Sci., USSR, Phys. Ser.

Izv. Akad. Nauk SSSR, Ser. Geol.
Izvestiya Akademii Nauk SSSR, Seriya Geologicheskaya (U.S.S.R.)

Izv. Akad. Nauk SSSR, Ser. Khim.
Izvestiya Akademii Nauk SSSR, Seriya Khimicheskaya (U.S.S.R.)
Issued in English Translation as Bull. Acad. Sci., USSR, Div. Chem. Sci.

Izv. Akad. Nauk Turkm. SSR, Ser. Fiz.-Tekh., Khim. Geol. Nauk
Izvestiya Akademii Nauk Turkmenskoi SSR, Seriya Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk (Turkmen S.S.R.)

Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk
Izvestiya Akademii Nauk Uzbekskoi SSR, Seriya Fiziko-Matematicheskikh Nauk (Uzbek S.S.R.)

Izv. Fiz. Inst. Aneb, Bulg. Akad. Nauk.
Izvestiya na Fizicheskiya Institut s Aneb, Bulgarska Akademiya na Naukite (Bulgaria)

Izv. Geofiz. Inst., Bulg. Akad. Nauki
Izvestiya na Geofizichniya Institut, Bulgarska Akademiya na Naukite, Otdelenie a Matematicheski i Fizicheski Nauki (Bulgaria)

Izv. Inst. Biokhim., Bulg. Akad. Nauk.
Izvestiya na Instituta po Biokhimiya, Bulgarska Akademiya na Naukite (Bulgaria)

Izv. Inst. Elektron., Bulg. Akad. Nauk.
Izvestiya na Instituta po Elektronika, Bulgarska Akademiya na Naukite (Bulgaria)

Izv. Inst. Fiziol. Rast., Bulg. Akad. Nauk.
Izvestiya na Instituta po Fiziologiya na Rasteniyata, Bulgarska Akademiya na Naukite (Bulgaria)

Izv. Inst. Khidrol. Meteorol., Bulg. Akad. Nauki
Izvestiya na Instituta po Khidrologiya i Meteorologiya, Bulgarska Akademiya na Naukite, Otdelenie za Matematicheski i Fizicheski Nauki (Bulgaria)

Izv. Inst. Srav. Patol. Shivotn., Bulg. Akad. Nauk.
Izvestiya na Instituta po Sravnitelna Patologiya na Zhivotnite, Bulgarska Akademiya na Naukite (Bulgaria)

Izv. Krym. Astrofiz. Observ.
Izvestiya Krymskoi Astrofizicheskoi Observatorii (U.S.S.R.)

Izv. Sekts. Astron., Bulg. Akad. Nauk.
Izvestiya na Sektsiyata po Astronomiya, Bulgarska Akademiya na Naukite (Bulgaria)

Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Biol. Nauk
Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, Seriya Biologicheskikh Nauk (U.S.S.R.)
Supersedes Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Biol.-Med. Nauk

Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk
Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, Seriya Khimicheskikh Nauk (U.S.S.R.)
Issued in English Translation as Siberian Chemistry Journal

Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Tekh. Nauk
Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, Seriya Tekhnicheskikh Nauk (U.S.S.R.)

Izv. Tomsk. Politekh. Inst.
Izvestiya Tomskogo Politekhnicheskogo Instituta imeni S. M. Kirova (U.S.S.R.)

Izv. Tsent. Khelmintol. Lab., Bulg. Akad. Nauk.
Izvestiya na Tsentralnata Khelmintologichna Laboratoriya, Bulgarska Kademiya na Naukite (Bulgaria)

Izv. Vyssh. Uchebn. Zaved., Aviats. Tekh.
Izvestiya Vysshikn Uchebmykh Zavedenii, Aviatsionnaya Tekhnika (U.S.S.R.)

Izv. Vyssh. Uchebn. Zaved., Chern. Metall.
Izvestiya Vysshikh Uchebnykh Zavedenii, Chernaya Metallurgiya (U.S.S.R.)

Izv. Vyssh. Uchebn. Zaved., Fiz.
Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika (U.S.S.R.)
Issued in English translation as Soviet Physics Journal

Izv. Vyssh. Uchebn. Zaved., Geol. Razved.
Izvestiya Vysshikh Uchebnykh Zavedenii, Geologiya i Razvedka (U.S.S.R.)

Izv. Vyssh. Uchebn. Zaved., Gorn. Zh.
Izvestiya Vysshikn Uchebnykh Zavedenii, Gornyi Zhurnal (U.S.S.R.)

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol.
Izvestiya Vysshikh Uchebnykh Zavedenii, Khimiya i Khimicheskaya Tekhnologiya (U.S.S.R.)

Izv. Vyssh. Uchebn. Zaved., Radioelektron.
Izvestiya Vysshikh Uchebnykh Zavedenii, Radioelektronika (Ukrainian S.S.R.)

Izv. Vyssh. Uchebn. Zaved., Radiofiz.
Izvestiya Vysshikh Uchebnykh Zavedenii, Radiofizika (U.S.S.R.) Issued in English translation as Sov. Radiophys.; English translation changed to Radiophys. Quantum Electron. (USSR)

Izv. Vyssh. Uchebn. Zaved., Tsvet. Metall.
Izvestiya Vyssnikh Uchebnykh Zavedenii, Tsvetnaya Metallurgiya (U.S.S.R.)

Izv. Vyssh. Ucheb. Zaved., Priborostr.
Izvestiya Vysshikh Uchebnykh Zavedenii, Priborostroenie (U.S.S.R.)

J

J. Acoust. Soc. Am.
Journal of the Acoustical Society of America (U.S.)

Jad. Energ.
Jaderna Energie (Czechoslovakia)

J. Aerosol Sci.
Journal of Aerosol Science (England)

J. Agric. Food Chem.
Journal of Agricultural and Food Chemistry (U.S.)

J. Agric. Univ. P. R.
Journal of Agriculture of the University of Puerto Rico, The (Puerto Rico)

J. Air Pollut. Control Assoc.
Journal of the Air Pollution Control Association (U.S.)

J. Am. Ceram. Soc.
Journal of The American Ceramic Society (U.S.)

J. Am. Chem. Soc.
Journal of The American Chemical Society (U.S.)

J. Am. Dent. Assoc.
Journal of The American Dental Association, The (U.S.)

J. Am. Med. Assoc.
Journal of The American Medical Association (U.S.)

J. Am. Soc. Hortic. Sci.
Journal of the American Society for Horticultural Science (U. S.)
Supersedes Proceedings of the American Society for Horticultural Science

J. Anim. Morphol. Physiol.
Journal of Animal Morphology and Physiology (India)

J. Anim. Sci.
Journal of Animal Science (U.S.)

J. Appl. Bacteriol.
Journal of Applied Bacteriology (England)

J. Appl. Chem. USSR (Engl. Transl.)
Journal of Applied Chemistry of the USSR (English Translation of Zhurnal Prikladnoi Khimii) (U.S.)

J. Appl. Crystallogr.
Journal of Applied Crystallography (Denmark)

J. Appl. Electrochem.
Journal of Applied Electrochemistry (England)

J. Appl. Math. Mech.
Journal of Applied Mathematics and Mechanics (USSR) (English Translation of Prikladnaya Matematika i Mekhanika) (England - U.S.)

J. Appl. Meteorol.
Journal of Applied Meteorology (U.S.)

J. Appl. Phys.
Journal of Applied Physics (U.S.)

J. Appl. Physiol.
Journal of Applied Physiology (U.S.)

J. Appl. Polym. Sci.
Journal of Applied Polymer Science (U.S.)

J. Arkansas Med. Soc.
Journal of The Arkansas Medical Society, The (U.S.)

J. Assam Sci. Soc.
Journal of the Assam Science Society (India)

J. Assoc. Off. Anal. Chem.
Journal of the Association of Official Analytical Chemists (Formerly Journal of the Association of Official Agricultural Chemists) (U.S.)

J. Atmos. Terr. Phys.
Journal of Atmospheric and Terrestrial Physics (Northern Ireland)

J. Aust. Ceram. Soc.
Journal of the Australian Ceramic Society (Australia)

J. Aust. Inst. Met.
Journal of the Australian Institute of Metals (Australia)

J. Bacteriol.
Journal of Bacteriology (U.S.)

J. Belge Radiol.
Journal Belge de Radiologie (Belgium)

J. Biochem. (Tokyo)
Journal of Biochemistry, The (Tokyo) (Japan)

J. Biol. Chem.
Journal of Biological Chemistry, The (U.S.)

J. Biol. Med. Nucl.
Journal de Biologie et de Medecine Nucleaires. Supplement au Bulletin d'Information A.T.E.N. (Association Technique pour l'Energie Nucleaire) (France)

J. Br. Nucl. Energy Soc.
Journal of the British Nuclear Energy Society, The (Formerly Journal of the British Nuclear Energy Conference) (England)

J. Calif. Dent. Assoc.
Journal of the California Dental Association (U.S.)
Supersedes J. Calif. State Dent. Ass.

J. Can. Ass. Radiol.
Journal of the Canadian Association of Radiologists (Canada)

J. Can. Ceram. Soc.
Journal of the Canadian Ceramic Society (Canada)

J. Cell Biol.
Journal of Cell Biology, The (Formerly Journal of Biophysical and Biochemical Cytology) (U.S.)

J. Cell. Physiol.
Journal of Cellular Physiology (Formerly Journal of Cellular and Comparative Physiology) (U.S.)

J. Cell Sci.
Journal of Cell Science (England)

J. Chem. Educ.
Journal of Chemical Education (U.S.)

J. Chem. Eng. Data
Journal of Chemical and Engineering Data (U.S.)

J. Chem. Phys.
Journal of Chemical Physics, The (U.S.)

J. Chem. Soc. (London), Chem. Commun.
Journal of the Chemical Society (London), Chemical Communications (England)
Supersedes J. Chem. Soc., D

J. Chem. Soc. (London), Dalton Trans.
Journal of the Chemical Society (London), Dalton Transactions (England)
Supersedes in part J. Chem. Soc., A

J. Chem. Soc. (London), Faraday Trans., I
Journal of the Chemical Society (London), Faraday Transactions, I (England)
Supersedes in part J. Chem. Soc., A and Trans. Faraday Soc.

J. Chem. Soc. (London), Faraday Trans., II
Journal of the Chemical Society (London), Faraday Transactions, II (England)
Supersedes in part J. Chem. Soc., A and Trans. Faraday Soc.

J. Chem. Soc. (London), Perkin Trans., II
Journal of the Chemical Society (London), Perkin Transactions, II (England)
Supersedes J. Chem. Soc., B

J. Chem. Thermodyn.
Journal of Chemical Thermodynamics, The (England - U.S.)

J. Chim. Phys.
Journal de Chimie Physique et de Physico-Chimie Biologique (France)

J. Chin. Chem. Soc. (Taiwan)
Journal of the Chinese Chemical Society (Taiwan) (China)

J. Chromatogr.
Journal of Chromatography (Netherlands)
Absorbed Chromatogr. Rev.

J. Chromatogr. Sci.
Journal of Chromatographic Science (U.S.)
Supersedes Journal of Gas Chromatography

J. Chronic Dis.
Journal of Chronic Diseases (U.S.)

J. Clin. Endocrinol. Metab.
Journal of Clinical Endocrinology and Metabolism, The (U.S.)

J. Clin. Invest.
Journal of Clinical Investigation, The (U.S.)

J. Clin. Pathol.
Journal of Clinical Pathology (England)

J. Colloid Interface Sci.
Journal of Colloid and Interface Science (Formerly Journal of Colloid Science) (U.S.)

J. Comp. Neurol.
Journal of Comparative Neurology, The (U.S.)

J. Compos. Mater.
Journal of Composite Materials (U.S.)

J. Comp. Pathol.
Journal of Comparative Pathology (Formerly Journal of Pathology and Therapeutics) (England)

J. Comp. Physiol. Psychol.
Journal of Comparative and Physiological Psychology (U.S.)

J. Comput. Phys.
Journal of Computational Physics (U.S.)

J. Coord. Chem.
Journal of Coordination Chemistry (England)

J. Cryst. Growth
Journal of Crystal Growth (Netherlands)

J. Cryst. Mol. Struct.
Journal of Crystal and Molecular Structure (England)

J. Dairy Sci.
Journal of Dairy Science (U.S.)

J. Econ. Entomol.
Journal of Economic Entomology (U.S.)

J. Electroanal. Chem.
Journal of Electroanalytical Chemistry (Netherlands)
Superseded by J. Electroanal. Chem. Interfacial Electrochem.

J. Electrochem. Soc.
Journal of the Electrochemical Society (U.S.)

J. Electron. Mater.
Journal of Electronic Materials (U.S.)

J. Electron Spectrosc. Relat. Phenom.
Journal of Electron Spectroscopy and Related Phenomena (Netherlands)

J. Embryol. Exp. Morphol.
Journal of Embryology and Experimental Morphology (England)

J. Endocrinol.
Journal of Endocrinology, The (England)

J. Eng. Ind.
Journal of Engineering for Industry. Transactions of the ASME (American Society of Mechanical Engineers), Series B (U.S.)

J. Eng. Mater. Technol.
Journal of Engineering Materials and Technology (U.S.)

J. Eng. Math.
Journal of Engineering Mathematics (Netherlands)

J. Eng. Mech. Div., Am. Soc. Civ. Eng.
Journal of the Engineering Mechanics Division, Proceedings of the American Society of Civil Engineers (U.S.)

J. Eng. Power
Journal of Engineering for Power, Transactions of the ASME (American Society of Mechanical Engineers), Series A (U.S.)

J. Environ. Qual.
Journal of Environmental Quality (U.S.)

J. Environ. Sci.
Journal of Environmental Sciences (U. S.)

JETP Lett. (USSR) (Engl. Transl.)
JETP Letters (USSR) (English Translation of Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki) (U.S.)

J. Exp. Mar. Biol. Ecol.
Journal of Experimental Marine Biology and Ecology (Netherlands)

J. Exp. Med.
Journal of Experimental Medicine (U.S.)

J. Exp. Zool.
Journal of Experimental Zoology (U.S.)

J. Fac. Eng., Univ. Tokyo, Ser. B
Journal of the Faculty of Engineering, University of Tokyo, Series B (Japan)

J. Fish. Res. Board Can.
Journal of the Fisheries Research Board of Canada (Canada)

J. Fluid Mech.
Journal of Fluid Mechanics (England)

J. Fluids Eng.
Journal of Fluids Engineering (U.S.)
Supersedes in part J. Basic Eng.

J. Food Sci.
Journal of Food Science (U.S.)

J. Food Sci. Technol. (India)
Journal of Food Science and Technology (India)

J. Franklin Inst.
Journal of the Franklin Institute (U.S.)

J. Funct. Anal.
Journal of Functional Analysis (U. S.)

J. Gen. Appl. Microbiol. (Tokyo)
Journal of General and Applied Microbiology (Tokyo) (Japan)

J. Gen. Chem. USSR (Engl. Transl.)
Journal of General Chemistry of the USSR (English Translation of Zhurnal Obshchei Khimii) (U.S.)

J. Gen. Virol.
Journal of General Virology (England)

J. Geol. Soc. Aust.
Journal of the Geological Society of Australia (Australia)

J. Geomagnet. Geoelec.
Journal of Geomagnetism and Geoelectricity (Japan)

J. Geophys.
Zeitschrift fuer Geophysik (West Germany)

J. Geophys. Res.
Journal of Geophysical Research (U.S.)

J. Geotech. Eng. Div., Am. Soc. Civil Eng.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers (U.S.)

J. Gerontol.
Journal of Gerontology (U.S.)

J. Heat Transfer
Journal of Heat Transfer, Transactions of the ASME (American Society of Mechanical Engineers), Series C (U.S.)

J. Histochem. Cytochem.
Journal of Histochemistry and Cytochemistry, The (U.S.)

J. Hydraul. Div., Am. Soc. Civ. Eng.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers (U.S.)

J. Hydrol.
Journal of Hydrology (Netherlands)

J. Hyg., Epidemiol., Microbiol., Immunol.
Journal of Hygiene, Epidemiology, Microbiology, and Immunology (Czechoslovakia)

Jibi To Rinsho
Jibi To Rinsho (Otologia Fukuoka) (Japan)

J. Immunol.
Journal of Immunology (U.S.)

J. Immunol. Methods
Journal of Immunological Methods (Netherlands)

J. Indiana State Med. Assoc.
Journal of Indiana State Medical Association (U.S.)

J. Indian Chem. Soc.
Journal of the Indian Chemical Society (India)

J. Indian Med. Assoc.
Journal of the Indian Medical Association (India)

J. Infect. Dis.
Journal of Infectious Diseases, The (U.S.)

J. Inorg. Nucl. Chem.
Journal of Inorganic and Nuclear Chemistry (England)

J. Insect Physiol.
Journal of Insect Physiology (U. S.)

J. Inst. Eng. (India)
Journal of the Institution of Engineers (India) (India)

J. Inst. Nucl. Eng.
Journal of the Institution of Nuclear Engineers (England)
Supersedes Nuclear Energy

J. Interdiscip. Cycle Res.
Journal of Interdisciplinary Cycle Research (Netherlands)

J. Invertebr. Pathol.
Journal of Invertebrate Pathology (U.S.)

J. Invest. Dermatol.
Journal of Investigative Dermatology, The (U.S.)

J. Iowa Med. Soc.
Journal of the Iowa Medical Society (U.S.)

J. Jap. Soc. Appl. Phys., Suppl.
Journal of the Japan Society of Applied Physics, Supplement (Japan)

J. Jiwaji Univ.
Journal of Jiwaji University (India)

J. Jpn. Inst. Met.
Journal of the Japan Institute of Metals (Nippon Kinzoku Gakkaishi) (Japan)

J. Kans. Med. Soc.
Journal of the Kansas Medical Society, The (U.S.)

J. Korean Inst. Electr. Eng.
Journal of the Korean Institute of Electrical Engineers, The (Daehan Jeonkihakhoe-ji) (South Korea)

J. Korean Inst. Electron. Eng.
Journal of the Korean Institute of Electronics Engineers, The (Jeonja-gongnakhoe-ji) (South Korea)

J. Korean Inst. Met.
Journal of the Korean Institute of Metals (South Korea)

J. Korean Nucl. Soc.
Journal of the Korean Nuclear Society (South Korea)

J. Korean Phys. Soc.
Journal of the Korean Physical Society (South Korea)

J. Korean Soc. Crop Sci.
Journal of the Korean Society of Crop Science (Hankuk Jakmulhakhoe-ji) (South Korea)

J. Korean Soc. Mech. Eng.
Journal of the Korean Society of Mechanical Engineers (South Korea)

J. Lab. Clin. Med.
Journal of Laboratory and Clinical Medicine, The (U.S.)

J. Labelled Compd.
Journal of Labelled Compounds (Belgium)

J. La. State Med. Soc.
Journal of the Louisiana State Medical Society (U.S.)

J. Less-Common Met.
Journal of the Less-Common Metals (Switzerland)

J. Lipid Res.
Journal of Lipid Research (U.S.)

J. Low Temp. Phys.
Journal of Low Temperature Physics (U.S.)

J. Lumin.
Journal of Luminescence (Netherlands)

J. Magn. Resonance
Journal of Magnetic Resonance (England)

J. Mass Spectrom. Ion Phys.
Journal of Mass Spectrometry and Ion Physics (Netherlands) (Title listing changed to Int. J. Mass Spectrom. Ion Phys.)

J. Mater. Sci.
Journal of Materials Science (England)

J. Math. Anal. Appl.
Journal of Mathematical Analysis and Applications (U.S.)

J. Math. Phys. (N.Y.)
Journal of Mathematical Physics (New York) (U.S.)

J. Mec.
Journal de Mecanique (France)

J. Mech. Phys. Solids
Journal of the Mechanics and Physics of Solids (England)

J. Med. Chem.
Journal of Medicinal Chemistry (U.S.)

J. Med. Genet.
Journal of Medical Genetics (U. S.)

J. Med. Primatol.
Journal of Medical Primatology (Switzerland)

J. Membrane Biol.
Journal of Membrane Biology (U. S.)

J. Met.
Journal of Metals (U.S.)

J. Microsc.
Journal of Microscopy (England)
Supersedes J. Roy. Microscop. Soc.

J. Mines, Met. Fuels
Journal of Mines, Metals and Fuels (India)

J. Mol. Struct.
Journal of Molecular Structure (Netherlands)

J. Natl. Cancer Inst.
Journal of the National Cancer Institute (U.S.)

J. Natl. Med. Assoc.
Journal of the National Medical Association (U.S.)

J. Neurobiol.
Journal of Neurobiology (U.S.)

J. Neurochem.
Journal of Neurochemistry (England)

J. Neurol., Neurosurg., Psychiatr.
Journal of Neurology, Neurosurgery, and Psychiatry (England)

J. Neurosurg.
Journal of Neurosurgery (U.S.)

J. Nonmet.
Journal of Nonmetals (England)

J. Nucl. Biol. Med.
Journal of Nuclear Biology and Medicine (Supersedes in Part Minerva Nucleare) (Italy)

J. Nucl. Mater.
Journal of Nuclear Materials (Journal des Materiaux Nucleaires) (Netherlands)

J. Nucl. Med.
Journal of Nuclear Medicine (U.S.)

J. Nucl. Sci. Technol. (Tokyo)
Journal of Nuclear Science and Technology (Tokyo) (Japan)

J. Occup. Med.
Journal of Occupational Medicine (U.S.)

J. Opt. Soc. Am.
Journal of the Optical Society of America (U.S.)

J. Oral Surg.
Journal of Oral Surgery (U.S.)

J. Org. Chem.
Journal of Organic Chemistry, The (U.S.)

J. Periodontal Res.
Journal of Periodontal Research (Denmark)

J. Pet. Technol.
Journal of Petroleum Technology (U.S.)

J. Pharm. Pharmacol., Suppl.
Journal of Pharmacy and Pharmacology, Supplement (England)

J. Pharm. Sci.
Journal of Pharmaceutical Sciences (U.S.)

J. Photogr. Sci.
Journal of Photographic Science (England)

J. Phys., A (London)
Journal of Physics, A (London). Proceedings of the Physical Society (General) (Supersedes in Part Proceedings of the Physical Society (London)) (England)

J. Phys., B (London)
Journal of Physics, B (London). Proceedings of the Physical Society (Atomic and Molecular Physics) (Supersedes in Part Proceedings of the Physical Society (London)) (England)

J. Phys. Chem.
Journal of Physical Chemistry, The (U.S.)

J. Phys. Chem. Ref. Data
Journal of Physical and Chemical Reference Data (U.S.)

J. Phys. Chem. Solids
Journal of Physics and Chemistry of Solids (Formerly Physics and Chemistry of Solids, The) (England)

J. Phys., C (London)
Journal of Physics, C (London) Proceedings of the Physic Society (Solid State Physics) (Supersedes in Part Proceedings of the Physical Society (London)) (England)

J. Phys., D (London)
Journal of Physics, D (London) (Supersedes British Journal of Applied Physics) (England)

J. Phys., E (London)
Journal of Physics, E (London) (Supersedes Journal of Scientific Instruments) (England)

J. Phys., F (London)
Journal of Physics, F (London). Metal Physics (England)

J. Phys. (Paris)
Journal de Physique (Paris) (Formerly le Journal de Physique et le Radium) (France)

J. Phys. (Paris), Colloq.
Journal de Physique (Paris), Colloque (France)

J. Phys. (Paris), Lett.
Journal de Physique (Paris), Lettres (France)

J. Phys. Soc. Jpn.
Journal of the Physical Society of Japan (Japan)

J. Plasma Phys.
Journal of Plasma Physics (England)

Jpn. Anal.
Japan Analyst (Bunseki Kagaku) (Japan)

Jpn. Heart J.
Japanese Heart Journal (Japan)

Jpn. J. Appl. Phys.
Japanese Journal of Applied Physics (Japan)

Jpn. J. Pharmacol.
Japanese Journal of Pharmacology, The (Japan)

J. Polymer Sci., Polym. Chem. Ed.
Journal of Polymer Science, Polymer Chemistry Edition (formerly Journal of Polymer Science, Part A-1. Polymer Chemistry) (U.S.)

J. Polym. Sci., Polym. Lett. Ed.
Journal of Polymer Science, Polymer Letters Edition (formerly Journal of Polymer Science, Part B. Polymer Letters) (U.S.)

J. Polym. Sci., Polym. Phys. Ed.
Journal of Polymer Science, Polymer Physics Edition (formerly Journal of Polymer Science, Part A-2. Polymer Physics) (U.S.)

J. Prakt. Chem.
Journal fuer Praktische Chemie (East Germany)

J. Pressure Vessel Technol.
Journal of Pressure Vessel Technology (U.S.)

J. Quant. Spectrosc. Radiat. Transfer
Journal of Quantitative Spectroscopy and Radiative Transfer (England)

J. Radiat. Curing
Journal of Radiation Curing (U.S.)

J. Radiat. Res.
Journal of Radiation Research (Japan)

J. Radioanal. Chem.
Journal of Radioanalytical Chemistry (Switzerland-Hungary)

J. Radiol., Electrol., Med. Nucl.
Journal de Radiologie, d'Electrologie, et de Medicine Nucleaire (France)

J. R. Astron. Soc. Can.
Journal of the Royal Astronomical Society of Canada (Canada)

J. Rech. Atmos.
Journal de Recherches Atmospheriques (France)

J. Reprod. Fertil.
Journal of Reproduction and Fertility (England)

J. Res. Natl. Bur. Stand., A
Journal of Research of the National Bureau of Standards, A (U.S.)

J. Res. U.S. Geol. Surv.
Journal of Research of the U.S. Geological Survey (U.S.)

J. S. Afr. Chem. Inst.
Journal of the South African Chemical Institute (South Africa)

J. Solid State Chem.
Journal of Solid State Chemistry (U. S.)

J. Solution Chem.
Journal of Solution Chemistry (U.S.)

J. Spacecr. Rockets
Journal of Spacecraft and Rockets (U.S.)

J. Speech Hear. Disord.
Journal of Speech and Hearing Disorders (U.S.)

J. Stat. Phys.
Journal of Statistical Physics (U.S. - England)

J. Steroid Biochem.
Journal of Steroid Biochemistry (England)

J. Struct. Chem. (USSR) (Engl. Transl.)
Journal of Structural Chemistry (USSR) (English Translation of Zhurnal Strukturnoi Khimii) (U.S.)

J. Surg. Oncol.
Journal of Surgical Oncology (U. S.)

J. Surg. Res.
Journal of Surgical Research, The (U.S.)

J. Tenn. Med. Assoc.
Journal of the Tennessee Medical Association (U.S.)

J. Test. Eval.
Journal of Testing and Evaluation (U.S.)
Supersedes J. Mater.

J. Therm. Anal.
Journal of Thermal Analysis (England)

J. Thorac. Cardiovasc. Surg.
Journal of Thoracic and Cardiovascular Surgery (U.S.)

J. Ultrastruct. Res.
Journal of Ultrastructure Research (U.S.)

J. Urol.
Journal of Urology, The (U.S.)

J. Vac. Sci. Technol.
Journal of Vacuum Science and Technology, The (U.S.)

J. Water Pollut. Control Fed.
Journal of the Water Pollution Control Federation (Formerly Sewage and Industrial Wastes) (U.S.)

J. Wildl. Manage.
Journal of Wildlife Management (U.S.)

K

Kagaku Keizai
Kagaku Keizai (Chemical Industrial Economy) (Japan)

Kagaku Kogaku
Kagaku Kogaku (Chemical Engineering) (Japan)

Kagaku Kojo
Kagaku Kojo (Cnemical Factory) (Japan)

Kagaku No Ryoiki
Kagaku No Ryoiki (Journal of Japanese Chemistry) (Japan)

Kagaku (Tokyo)
Kagaku (Tokyo) (Science) (Japan)

Kagawa Daigaku Nogakubu Gakujutsu Hokoku
Kagawa Daigaku Nogakubu Gakujutsu hokoku (Technical Bulletin of Faculty of Agriculture, Kagawa University) (Japan)

Kagoshima Daigaku Igaku Zasshi
Kagoshima Daigaku Igaku Zassni (Medical Journal of Kagoshima University) (Japan)

Kajima Kensetsu Gijutsu Kenkyusho Nempo
Kajima Kensetsu Gijutsu Kenkyusho Nempo (Annual Report of The Kajima Construction Technical Research Institute) (Japan)

Kaku Igaku
Kaku Igaku (Nippon Kaku Igakkai Kikanshi) (Japanese Journal of Nuclear Medicine) (Japan)

Kakuriken Kenkyu Hokoku
Kakuriken Kenkyu Hokoku (Research Report of the Laboratory of Nuclear Science, Tohoku University) (Japan)

Kanagawa-ken Kogyo Shikenjo Kenkyu Hokoku
Kanagawa-ken Kogyo Shikenjo Kenkyu Hokoku (Bulletin of the Industrial Research Institute of Kanagawa Prefecture) (Japan)

Kanazawa Irigaku Sosho
Kanazawa Irigaku Sosho (Journal of Radiology and Physical Therapy, University of Kanazawa, The) (Japan)

Kanzo
Kanzo (Acta Hepatologica Japonica) (Japan)

Kardiologiya
Kardiologiya (U.S.S.R.)

Karyoku Genshiryoku Hatsuden
Karyoku Genshiryoku Hatsuden (Thermal and Nuclear Power) (Japan)
Supersedes Karyoku Hatsuden

Karyoku Hatsuden
Karyoku Hatsuden (The Thermal Power) (Japan)
Continued as Karyoku Genshiryoku Hatsuden

Kauchuk Rezina
Kauchuk i Rezina (U.S.S.R.)

Kawasaki Seitetsu Giho
Kawasaki Seitetsu Giho (Kawasaki Steelmaking Technical Report) (Japan)

K. Dan. Vidensk. Selsk., Mat.-Fys. Medd.
Kongelige Danske Videnskabernes Selskab, Det, Matematisk-Fysisk Meddelelser (Denmark)

Keikinzoku
Keikinzoku (Light Metals (Tokyo)) (Japan)

Keikinzoku Yosetsu
Keikinzoku Yosetsu (Japan Light Metal Welding) (Japan)

Keisoku To Seigyo
Keisoku To Seigyo (Journal of the Society of Instrument and Control Engineers) (Japan)

Kem. Kozl.
Kemiai Kozlemenyek (Formerly Magyar Tudomanyos Akademia Kemiai Tudomanyos Osztalyanak Kozlemenyei) (Hungary)

Kernenergie
Kernenergie (East Germany)

Kerntechnik
Kerntechnik Vereinigt mit Atompraxis. The Journal for Nuclear Engineers and Scientists (West Germany)

Ketsueki To Myakkan
Ketsueki To Myakkan (Blood and Vessel) (Japan)

KFK Nachr.
KFK (Kernforschungszentrum Karlsruhe) Nachrichten (West Germany)

Khidrol. Meteorol.
Khidrologiya i Meteorologiya (Bulgaria)

Khig. Zdraveopazvane
Khigiena i Zdraveopazvane (Bulgaria)

Khim.-Farm. Zh.
Khimiko-Farmatsevticheskii Zhurnal (U.S.S.R.)

Khim. Ind. (Sofia)
Khimiya i Industriya (Sofia) (Bulgaria)

Khim. Plazmy
Khimiya Plazmy (U.S.S.R.)

Khim. Prom. (Moscow)
Khimicheskaya Promyshlennost (Moscow) (U.S.S.R.)

Khim. Tverd. Topl.
Khimiya Tverdogo Topliva (U.S.S.R.)

Kinet. Catal. (USSR) (Engl. Transl.)
Kinetics and Catalysis (USSR) (English Translation of Kinetika i Kataliz) (U.S.)

Kinki Daigaku Genshiryoku Kenkyusho Nenpo
Kinki Daigaku Genshiryoku Kenkyusho Nenpo (Annual Reports of Kinki University Atomic Energy Research Institute) (Japan)

Kinzoku Zairyo Gijutsu Kenkyusho Kenkyu Hokoku
Kinzoku Zairyo Gijutsu Kenkyusho Kenkyu Hokoku (Report of the National Research Institute for Metals) (Japan)

Kiserl. Orvostud.
Kiserletes Orvostudomany (Hungary)

Kleinheubacher Ber.
Kleinheubacher Berichte (East Germany)

Klima Kaelteing.
Klima und Kaelteingenieur (West Germany)
Supersedes Kaeltetech.-Klim

Klin. Oczna
Klinika Oczna (Poland)

Klin. Wochenschr.
Klinische Wochenschrift (West Germany)

Kobe Shosen Daigaku Kiyo. Dai-2-rui. Kokai, Kikan, Rigaku-hen
Kobe Shosen Daigaku Kiyo. Dai-2-rui. Kokai, Kikan, Rigaku-hen (Review of Kobe University of Mercantile Marine. Part II. Navigation, Marine Engineering, and Scientific Section) (Japan)

Kobunshi
Kobunshi (High Polymers, Japan) (Japan)

Kobunshi Ronbunshu
Kobunshi Ronbunshu (Collected Papers on High Polymers) (Japan)
Supersedes Kobunshi Kagaku

Kogai
Kogai (Pollution Control) (Japan)

Kohaszat
Kohaszat (Formerly Kohaszati Lapok) (Hungary)

K'o Hsueh Shih Yen
K'o Hsueh Shih Yen (Science Experiments) (China)

K'o Hsueh T'ung Pao
K'o Hsueh T'ung Pao (Scientia) (China)

Koks Khim.
Koks i Khimiya (U.S.S.R.)
Issued in English translation as Coke Chem., USSR

Koks, Smola, Gaz
Koks, Smola, Gaz (Poland)

Kokyu To Junkan
Kokyu To Junkan (Respiration and Circulation) (Japan)

Kolloid-Z. Z. Polym.
Kolloid-Zeitschrift und Zeitschrift fuer Polymere, zur Zeit Vereinigt mit den Kolloid-Beiheften (Formerly Kolloid-Zeitschrift, -Zeitschrift fuer Polymere) (West Germany)
Changed to Colloid Polym. Sci.

Konkurito Janaru
Konkurito Janaru (Concrete Journal) (Japan)

Konzerv- Paprikaip.
Konzerv- es Paprikaipar (Hungary)

Koolaj Foldgaz
Koolaj es Foldgaz (Hungary)

Korean Biochem. J.
Korean Biochemical Journal, The (Hankuk Saenghwahakhoe-ji) (South Korea)

Korean J. Microbiol.
Korean Journal of Microbiology (South Korea)

Korean J. Vet. Res.
Korean Journal of Veterinary Research (South Korea)

Kosm. Biol. Aviakosmicheskaya Med.
Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina
Supersedes Kosm. Biol. Med.

Kosm. Biol. Med.
Kosmicheskaya Biologiya i Meditsina (U.S.S.R.) Issued in English Translation as Space Biology and Medicine (USSR)
Superseded by Kosm. Biol. Aviakosmicheskaya Med.

Kosm. Issled. Ukr.
Kosmicheskie Issledovaniya na Ukraine (Ukrainian S.S.R.)

Kosm. Luchi
Kosmicheskie Luchi (U.S.S.R.)

Kotsu Igaku
Kotsu Igaku (The Journal of Transportation Medicine) (Japan)

Kotsu Taisha
Kotsu Taisha (Bone Metabolism) (Japan)

Kovove Mater.
Kovove Materialy (Czechoslovakia)

Kozan Chishitsu
Kozan Chishitsu (Mining Geology) (Japan)

Krankenpflege
Krankenpflege (West Germany)

Kratk. Soobshch. Fiz.
Kratkie Soobshcheniya po Fizike (U.S.S.R.)

K'un Ch'ung Hsueh Pao
K'un Ch'ung Hsueh Pao (Acta Entomologica Sinica) (China)

Kvantovaya Elektron. (Moscow)
Kvantovaya Elektronika (Moscow) (U.S.S.R.)
Issued in English translation as Sov. J. Quantum Electron.

KWU-Rep.
KWU-Report (Kraftwerk Union A.G.) (West Germany)

Kyoto Furitsu Daigaku Gakujutsu Hokoku (Rigaku, Seikatsu Kagaku)
Kyoto Furitsu Daigaku Gakujutsu Hokoku (Rigaku, Seikatsu Kagaku) (Scientific Reports of the Kyoto Prefectural University (Natural Science and Life Science)) (Japan)

Kyoto Furitsu Ika Daigaku Zasshi
Kyoto Furitsu Ika Daigaku Zasshi (Journal of Kyoto Prefectural Medical University) (Japan)

Kyushu Daigaku Kogaku Shuho
Kyushu Daigaku Kogaku Shuho (Technology Reports of the Kyushu University) (Japan)

L

Lab. Delo
Laboratornoe Delo (U.S.S.R.)

Lab. Invest.
Laboratory Investigation. A Journal of Experimental Methods and Pathology (U.S.)

Lab. Pract.
Laboratory Practice (England)

Laekartidningen
Laekartidningen (Sweden)
Supersedes Svenska Laekartidningen

Lakokrasoch. Mater. Ikh Primen.
Lakokrasochnye Materialy i Ikh Primenenie (U.S.S.R.)

Lancet
Lancet, The (England)

Laryngoscope
Laryngoscope, The (U.S.)

Laser Focus
Laser Focus (U. S.)

Latv. PSR Zinat. Akad. Vestis
Latvijas PSR Zinatnu Akademijas Vestis (Latvian S.S.R.)

Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.
Latvijas PSR Zinatnu Akademijas Vestis, Fizikas un Tehnisko Zinatnu Serija (Latvian S.S.R.)

Leitz-Mitt. Wiss. Tech.
Leitz-Mitteilungen fuer Wissenschaft und Technik (West Germany)

Letop. Khig. Epidemiol. Inst.
Letopisi na Khigienno Epidemiologichnite Instituti (Bulgaria)

Lett. Nuovo Cim.
Lettere al Nuovo Cimento (Italy)

Liet. Fiz. Rinkinys
Lietuvos Fizikos Rinkinys (Lithuanian S.S.R.)

Liet. TSR Moksl Akad. Darbai, Ser. B
Lietuvos TSR Moksl Akademijos Darbai, Serija B (Lithuanian S.S.R.)

Liet. TSR Moksl Akad. Darbai, Ser. C
Lietuvos TSR Moksl Akademijos Darbai, Serija C. Biologijos Moksl (Lithuanian S.S.R.)

Life Sci.
Life Sciences (U.S.)
Divided into Parts I and II; reverted to former title with Vol.13, No. 1, July 1, 1973

Limnol. Oceanogr.
Limnology and Oceanography (U.S.)

Liteinoe Proizvod.
Liteinoe Proizvodstvo (U.S.S.R.)

Lithos
Lithos (Norway)

Litol. Polez. Iskop.
Litologiya i Poleznye Iskopaemye (U.S.S.R.)

M

Mach. Outil Fr.
Machine Outil Francaise (France)

Madras Agric. J.
Madras Agricultural Journal (India)

Mag. Concr. Res.
Magazine of Concrete Research (England)

Magn. Gidrodin.
Magnitnaya Gidrodinamika, Akademiya Nauk Latviiskoi SSR (Latvian S.S.R.) Issued in English translation as Magnetohydrodynamics (USSR)

Magnitogidrodin. Metod Preobraz. Energ.
Magnitogidrodinamicheskii Metod Preobrazovaniya Energii (U.S.S.R.)

Magy. Fiz. Foly.
Magyar Fizikai Folyoirat (Hungary)

Magy. Kem. Foly.
Magyar Kemiai Folyoirat (Hungary)

Magy. Radiol.
Magyar Radiologia (Hungary)

M.A.N. (Maschinenfabr. Augsb.-Nuernb.) Forsch., Planen, Bauen
M.A.N. (Maschinenfabrik Augsburg-Nuernberg) Forschen, Planen, Bauen (West Germany)

Mar. Chem.
Marine Chemistry (Amsterdam) (Netherlands)

Mar. Geol.
Marine Geology (Netherlands)

Mar. Pollut. Bull.
Marine Pollution Bulletin (England)

Maschinenmarkt
Maschinenmarkt (West Germany)

Maschinenschaden
Maschinenschaden (West Germany)

Mashinostroene
Mashinostroene (Bulgaria)

Mashinovedenie
Mashinovedenie (U.S.S.R.)

Mater. Eng.
Materials Engineering (Formerly Materials in Design Engineering) (U.S.)

Mater. Eval.
Materials Evaluation (Formerly Nondestructive Testing) (U.S.)

Materialpruefung
Materialpruefung (West Germany)

Mater. Performance
Materials Performance (U.S.)
Supersedes Mater. Protect. Performance

Mater. Res. Bull.
Materials Research Bulletin (U.S.)

Mater. Tech.
Materiaux et Techniques (France)

Math. Biosci.
Mathematical Biosciences (U.S.)

Math. Comput.
Mathematics of Computation (U.S.)

Math. Trans. (Engl. Transl.)
Mathematical Transactions (English Translation of Litovskii Matematicheskii Sbornik) (U.S.)

Mat. Vesn., Nova Ser.
Matematichki Vesnik, Nova Seriya (Yugoslavia)

Meas. Tech. (USSR) (Engl. Transl.)
Measurement Techniques (USSR) (English Translation of Izmeritelnaya Tekhnika) (U.S.)

Mech. Chem. Eng. Trans.
Mechanical and Chemical Engineering Transactions (Australia)

Mech. Eng.
Mechanical Engineering (U.S.)

Mec. Mater. Electr.
Mecanique Materiaux Electricite (France)
Supersedes Mecanique Electricite

Meded. K. Acad. Wet., Lett. Schone Kunsten Belg., Kl. Wet.
Mededelingen van de Koninklijke Academie voor Wetenschappen, Letteren en Schone Kunsten van Belgie, Klasse der Wetenschappen (Belgium)

Medicamundi
Medicamundi (Netherlands)

Med. Interna
Medicina Interna (Romania)

Med. Istraz.
Medicinska Istrazivanja (Yugoslavia)

Med. J. Osaka Univ. (Engl. Ed.)
Medical Journal of Osaka University (English Edition) (Japan)

Med. Klin. (Munich)
Medizinische Klinik (Munich) (West Germany)

Med. Lab. Technol.
Medical Laboratory Technology (England)
Supersedes J. Med. Lab. Technol.

Med. Phys.
Medical Physics (U.S.)

Med. Radiol.
Meditsinskaya Radiologiya (U.S.S.R.) Issued in English translation as Med. Radiol. (USSR)

Med. Res. Eng.
Medical Research Engineering (Formerly American Journal of Medical Electronics) (U.S.)

Med. Welt
Medizinische Welt, Die (West Germany)

Med. Water.
Medycyna Weterynaryjna (Poland)

Meerestechnik
Meerestechnik/Marine Technology (West Germany)

Melliand Textilber. Int.
Melliand Textilberichte International (West Germany)
Supersedes Melliand Textilber.

Mem. Chubu Inst. Technol.
Memoirs of Chubu Institute of Technology (Chubu Koygo Daigaku Kyo) (Japan)

Mem. Fac. Eng., Kobe Univ.
Memoirs of the Faculty of Engineering, Kobe University (Japan)

Mem. Inst. Sci. Ind. Res., Osaka Univ.
Memoirs of the Institute of Scientific and Industrial Research, Osaka University (Japan)

Mem. Poudres
Memorial des Poudres (France)

Mem. Sci. Rev. Metall.
Memoires Scientifiques de la Revue de Metallurgie, Les (Formerly a Part of Revue de Metallurgie) (France)

Mercury
Mercury (U.S.)

Messtechnik
Messtechnik. Zeitschrift fuer Instrumentenkunde (Supersedes Zeitschrift fuer Instrumentenkunde) (West Germany)

Metall
Metall. Internazionale Zeitschrift fuer Technik und Wirtschaft (West Germany)

Metall. Eng. - IIT (Indian Inst. Technol.)
Metallurgical Engineer - IIT (Indian Institute of Technology) Bombay (India)

Metall. Ital.
Metallurgia Italiana (Includes the Section Atti Notizie, Associazione Italiana de Metallurgia) (Italy)

Metall. Met. Form.
Metallurgia and Metal Forming (England)
Formed by merger of Metallurgia and Metal Forming

Metalloberflaeche
Metalloberflaeche (West Germany)
Changed to Metalloberflaeche-Angew. Elektrochem.

Metalloberflaeche-Angew. Elektrochem.
Metalloberflaeche- Angewandte Elektrochemie (West Germany)
Supersedes Metalloberflaeche

Metallofizika
Metallofizika (Ukrainian S.S.R.)

Metallography
Metallography. An International Journal (U.S.)

Metallogr. Rev.
Metallographic Review (U.S.)

Metalloved. Term. Obrab. Met.
Metallovedenie i Termicheskaya Obrabotka Metallov (Formerly Metallovedenie i Obrabotka Metallov) (U.S.S.R.)
For English Translation see Metal Science and Heat Treatment (USSR)

Metall. Trans.
Metallurgical Transactions (formerly Transactions of the Metallurgical Society of AIME and Transactions Quarterly of American Society for Metals) (U. S.)

Metall. Trans., A
Metallurgical Transactions, A. Physical Metallurgy and Materials Science (U.S.)
Supersedes in part Metall. Trans.

Metallurgia
Metallurgia (England)
Combined with Metal Forming to form Metallurgia and Metal Forming

Metallurgie (Mons, Belg.)
Metallurgie (Mons, Belgium) (Belgium)

Metalurgia (Sao Paulo)
Metalurgia (Sao Paulo) (Brazil)

Metalurgiya (Sofia)
Metalurgiya (Sofia) (Bulgaria)

Metaux (Corros.-Ind.)
Metaux (Corrosion-Industrie) (France)

Met. Eng. Q.
Metals Engineering Quarterly (U.S.)

Meteoritika
Meteoritika (U.S.S.R.)

Met. Finish.
Metal Finishing (U.S.)

Methods Biochem. Anal.
Methods of Biochemical Analysis (U.S.)

Met. Prog.
Metal Progress (U.S.)

Metrol. Insp.
Metrology and Inspection (England)

Metrologia
Metrologia (West Germany)

Met. Sci.
Metal Science (England)
Supersedes Met. Sci. J.

Met. Sci. Heat Treat. (USSR) (Eng. Transl.)
Metal Science and Heat Treatment (USSR) (English Translation of Metallovedenie i Termicheskaya Obrabotka Metallov) (U.S.)

Met. Sci. J.
Metal Science Journal (England)

Mezhdunar. S-kh. Zh.
Mezhdunarodnyi Sel'skokhozyaistvennyi Zhurnal (U.S.S.R.)

Microbios
Microbios (U. S.)

Microwaves
Microwaves (U.S.)

Mikrobiologiya
Mikrobiologiya (U.S.S.R.) For English Translation see Microbiology (USSR)

Mikrochim. Acta
Mikrochimica Acta (Formerly Mikrochimica et Ichoanalytica Acta) (Austria)

Milchwissenschaft
Milchwissenschaft (West Germany)

Minerva Med.
Minerva Medica (Italy)

Mitsubishi Denki Giho
Mitsubishi Denki Giho (Mitsubishi Denki Technical Review) (Japan)

Mitsubishi Juko Giho
Mitsubishi Juko Giho (Mitsubishi Heavy Industries Technical Review) (Japan)

Mitt. Astron. Ges.
Mitteilungen der Astronomischen Gesellschaft (West Germany)

Mitt. Brennstoffinst. Freiberg
Mitteilungen des Brennstoffinstitutes Freiberg (East Germany)

Mitt. Geb. Lebensmitteluntersuch. Hyg.
Mitteilungen aus dem Gebiete der Lebensmitteluntersuchung und Hygiene (Switzerland)

Miyazaki Daigaku Kogakubu Kenkyu Hokoku
Miyazaki Daigaku Kogakubu Kenkyu Hokoku (Bulletin of the Faculty of Engineering, Miyazaki University) (Japan)

Mod. Power Eng.
Modern Power and Engineering (Canada)

Mol. Biol. Rep.
Molecular Biology Reports (Netherlands)

Mol. Biol. (USSR) (Engl. Transl.)
Molecular Biology (USSR) (English Translation of Molekulyarnaya Biologiya) (U.S.)

Mol. Cryst. Liq. Cryst.
Molecular Crystals and Liquid Crystals (formerly Molecular Crystals) (England)

Mol. Gen. Genet.
Molecular and General Genetics (MGG) (Continuation of Zeitschrift fuer Vererbungslehre) (West Germany)

Mol. Phys.
Molecular Physics (England)

Monatsh. Chem.
Monatshefte fuer Chemie (Austria)

Monatsschr. Kinderheilkd.
Monatsschrift fuer Kinderheilkunde (West Germany)

Mon. Not. R. Astron. Soc.
Monthly Notices of the Royal Astronomical Society (England)

Monogr. Neoplast. Dis. Various Sites
Monographs on Neoplastic Disease at Various Sites (Scotland)

Morsk. Gidrofiz. Issled.
Morskie Gidrofizicheskie Issledovaniya (U.S.S.R.)

Motortech. Z.
Motortechnische Zeitschrift (West Germany)

Mt. Sinai J. Med.
Mount Sinai Journal of Medicine, The (U.S.)

Muehle Mischfuttertech.
Muehle und Mischfuttertechnik (West Germany)
Supersedes Muehle

Muench. Med. Wochenschr.
Muenchener Medizinische Wochenschrift (West Germany)

Musz. Tud.
Muszaki Tudomany (Formerly Magyar Tudomanyos Akademia Muszaki Tudomanyok Osztayanak Kozlemenyeia) (Hungary)

Mutat. Res.
Mutation Research (Netherlands)
Absorbed Newslett. Environ. Mutagen Soc.

Mycopathol. Mycol. Appl.
Mycopathologia et Mycologia Applicata (Netherlands)

N

Nachr. Chem. Tech.
Nachrichten aus Chemie und Technik (Supplement to Angew. Chem.) (West Germany)

Nagoya J. Med. Sci.
Nagoya Journal of Medical Science, The (Japan)

Nagoya Kogyo Gijutsu Shikensho Hokoku
Nagoya Kogyo Gijutsu Shikensho Hokoku (Reports of the Government Industrial Research Institute, Nagoya) (Japan)

Nahrung
Nahrung, Die (East Germany)

Natl. Saf.
National Safety (South Africa)

Nat. Resour. Lawyer
Natural Resources Lawyer (U.S.)

Nature (London)
Nature (London) (England)

Nature (London) Phys. Sci.
Nature (London) Physical Science (England) Absorbed by Nature (London)

Naturwissenschaften
Naturwissenschaften, Die (West Germany)

Naturwiss. Rundsch.
Naturwissenschaftliche Rundschau (West Germany)

Nauchni Tr., Vissh Selskostop. Inst., Plovdiv
Nauchni Trudove, Vissh Selskostopanski Institut Vasil Kolarov, Plovdiv (Bulgaria)

Nauchni Tr., Vissh Selskostop. Inst., Sofia, Zootekh. Fak.
Nauchni Trudove, Vissh Selskostopanski Institut Georgi Dimitrov, Sofia, Zootekhnicheski Fakultet (Bulgaria)

Nauchn. Tr., Gos. Nauchno-Issled. Proektn. Inst. Redkomet. Prom-sti.
Nauchnye Trudy, Gosudarstvennyi Nauchno-Issledovatel'skii i Proektnyi Institut Redkometallicheskoi Promyshlennosti (U.S.S.R.)

Nauchn. Tr., Perm. Politekh. Inst.
Nauchnye Trudy, Permskii Politekhnicheskii Institut (U.S.S.R.)

Nauchn. Tr., Vses. Nauchno-Issled. Proekt. Inst. Tugoplavkikh Met. Tverd. Splavov
Nauchnye Trudy, Vsesoyuznyi Nauchno-Issledo- vatel'skii i Proektnyi Institut Tugoplavkikh Metallov i Tverdykh Splavov (U.S.S.R.)

Naucno-Teh. Pregl.
Naucno-Tehnicki Pregled (Yugoslavia)

Naunyn-Schmiedebergs Arch. Pharmakol.
Naunyn-Schmiedebergs Archiv fuer Pharmakologie (Formerly Archiv fuer Pharmakologie und Experimentelle Pathologie, Naunyn-Schmiedebergs) (West Germany)

Nav. Res. Rev.
Naval Research Reviews (U. S.)

Ned. Mil. Geneeskd. Tijdschr.
Nederlands Militair Geneeskundig Tijdschrift (Netherlands)

Ned. Tijdschr. Natuurkd.
Nederlands Tijdschrift voor Natuurkunde (Netherlands)

Nefteprom. Delo
Neftepromyslovoe Delo (U.S.S.R.)

Nenryo Kyokai-shi
Nenryo Kyokai-shi (Journal of the Fuel Society of Japan) (Japan)

Neoplasma
Neoplasma (Czechoslovakia)

Neorg. Mater.
Neorganicheskie Materialy (U.S.S.R.)
See Izvestiya Akademii Nauk SSSR, Neorganicheskie Materialy

Neth. J. Plant Pathol.
Netherlands Journal of Plant Pathology (Netherlands)

Neth. J. Sea Res.
Netherlands Journal of Sea Research (Netherlands)

Neue Huette
Neue Huette (East Germany)

Neue Tech.
Neue Technik (Switzerland)
Supersedes Neue Tech., A and B

Neurobiology
Neurobiology (Denmark)

Neuroendocrinology
Neuroendocrinology (Switzerland)

Neuropatol. Pol.
Neuropatologia Polska (Poland)

New Engl. J. Med.
New England Journal of Medicine, The (U.S.)

New Phys. (S. Korea)
New Physics (South Korea)

New Sci.
New Scientist (England)
Merged with Science Journal to form New Scientist and Science Journal; changed back to New Scientist with Dec. 2, 1971 issue

Nichidai Igaku Zasshi
Nichidai Igaku Zasshi (Nihon University Medical Journal) (Japan)

Niedersaechs. Ministerialbl.
Niedersaechsisches Ministerialblatt (West Germany)

Nihon Univ. J. Med.
Nihon University Journal of Medicine, The (Japan)

Ningen Kogaku
Ningen Kogaku (Japanese Journal of Ergonomics) (Japan)

Nippon Gan Chiryo Gakkai-Shi
Nippon Gan Chiryo Gakkai-Shi (Journal of Japan Society for Cancer Therapy, The) (Japan)

Nippon Ganka Gakkai Zasshi
Nippon Ganka Gakkai Zasshi (Acta Societatis Ophthalmologicae Japonicae) (Japan)

Nippon Geka Gakkai Zasshi
Nippon Geka Gakkai Zasshi (Japan)

Nippon Genshiryoku Gakkaishi
Nippon Genshiryoku Gakkaishi (Journal of the Atomic Energy Society of Japan) (Japan)

Nippon Genshiryokusen Kaihatsu Jigyodan Nenpo
Nippon Genshiryokusen Kaihatsu Jigyodan Nenpo (Japan)

Nippon Hinyokika Gakkai Zasshi
Nippon Hinyokika Gakkai Zasshi (The Japanese Journal of Urology) (Japan)

Nippon Igaku Hoshasen Gakkai Zasshi
Nippon Igaku Hoshasen Gakkai Zasshi (Nippon Acta Radiologica (Japan)

Nippon Ika Daigaku Zasshi
Nippon Ika Daigaku Zasshi (Journal of Japan Medical College) (Japan)

Nippon Kagaku Kaishi
Nippon Kagaku Kaishi (Journal of the Chemical Society of Japan, Chemistry and Industrial Chemistry) (Japan)
Supersedes Nippon Kagaku Zasshi and Kogyo Kagaku Zasshi

Nippon Kikai Gakkai Rombunshu
Nippon Kikai Gakkai Rombunshu (Transactions of the Japanese Society of Mechanical Engineers) (Japan)

Nippon Kikai Gakkaishi
Nippon Kikai Gakkaishi (Journal of the Japan Society of Mechanical Engineers) (Japan)

Nippon Kinzoku Gakkai Kaiho
Nippon Kinzoku Gakkai Kaiho (Bulletin of the Japan Institute of Metals) (Japan)

Nippon Kokua Gakkai Zasshi
Nippon Kokua Gakkai Zasshi (Journal of the Japanese Stomatological Society) (Japan)

Nippon Kyobu Geka Gakkai Zasshi
Nippon Kyobu Geka Gakkai Zasshi (Journal of the Japanese Association for Thoracic Surgery) (Japan)

Nippon Kyobu Rinsho
Nippon Kyobu Rinsho (The Japanese Journal of Chest Diseases) (Japan)

Nippon Rinsho
Nippon Rinsho (Japanese Journal of Clinical Medicine) (Japan)

Nippon Sakumotsu Gakkai Kiji
Nippon Sakumotsu Gakkai Kiji (Proceedings of the Crop Science Society of Japan) (Japan)

Nippon Sanka Fujinka Gakkai Zasshi
Nippon Sanka Fujinka Gakkai Zasshi (Journal of Japanese Obstetrics and Gynecological Society) (Japan)

Nippon Sanshigaku Zasshi
Nippon Sanshigaku Zasshi (The Journal of Sericultural Science of Japan) (Japan)

Nippon Seikei Geka Gakkai Zasshi
Nippon Seikei Geka Gakkai Zasshi (Journal of Japanese Orthopaedic Association) (Japan)

Nippon Shokuhin Kogyo Gakkaishi
Nippon Shokuhin Kogyo Gakkaishi (Journal of Food Science and Technology) (Japan)

Nippon Suisan Gakkaishi
Nippon Suisan Gakkaishi (Bulletin of the Japanese Society of Scientific Fisheries) (Japan)

Nippon Yakurigaku Zasshi
Nippon Yakurigaku Zasshi (Folia Pharmacologica Japonica) (Japan)

Nippon Zosen Kenkyu Kyokai Hokoku
Nippon Zosen Kenkyu Kyokai Hokoku (Japan)

Nishinihon J. Urol.
Nishinihon Journal of Urology (Japan)

NML (Natl. Metall. Lab.) Tech. J. (Jamshedpur, India)
NML (National Metallurgical Laboratory) Technical Journal (Jamshedpur, India) (India)

Nogyo Doboku Shikenjo Hokoku
Nogyo Doboku Shikenjo Hokoku (Bulletin of the Agricultural Engineering Research Station) (Japan)

Nondestr. Test. (Guildford, Engl.)
Non-Destructive Testing (Guildford, England) (England)

Nord. Betong
Nordisk Betong (Sweden)

Norinsho Kachiku Eisei Shikenjo Kenkyu Hokoku
Norinsho Kachiku Eisei Shikenjo Kenkyu Hokoku (Bulletin of National Institute of Animal Health) (Japan)

Nor. Lovtid.
Norsk Lovtidend (Norway)

Nor. Tannlaegeforen. Tid.
Norske Tannlaegeforenings Tidende (Norway)

Notas Fis., Cent. Bras. Pesqui. Fis.
Notas de Fisica, Centro Brasileiro de Pesquisas Fisicas (Brazil)

No To Shinkei
No To Shinkei (Brain and Nerve) (Japan)

Nouv. Presse Med.
Nouvrelle Presse Medicale, La (France)
Supersedes Presse Medicale, La

Nouv. Rev. Opt.
Nouvelle Revue d'Optique (France)
Supersedes Nouv. Rev. Opt. Appl.

NSFI (Nor. Skipaforsk. Inst.) Nytt
NSFI (Norges Skipaforsknings Institutt) Nytt (Norway)

Nucl. Data Sheets
Nuclear Data Sheets (formerly carried as Nuclear Data, Section B) (U.S.)

Nucleic Acids Res.
Nucleic Acids Research (England)

Nucl. Eng. Des.
Nuclear Engineering and Design (Formerly Nuclear Structural Engineering) (Netherlands)

Nucl. Eng. Int.
Nuclear Engineering International Incorporating Nuclear Power (Formerly Nuclear Engineering) (England)

Nucl. Fusion
Nuclear Fusion (Journal of Plasma Physics and Thermonuclear Fusion) (Austria)

Nucl. India
Nuclear India (India)

Nucl. Instrum. Methods
Nuclear Instruments and Methods (Formerly Nuclear Instruments) (Netherlands)

Nucl. Mater. Manage.
Nuclear Materials Management (U.S.)

Nucl.-Med.
Nuclear-Medizin (West Germany)

Nucl.-Med., Suppl.
Nuclear-Medizin, Supplementum (West Germany)

Nucl. News
Nuclear News (U.S.)

Nucl. Phys., A
Nuclear Physics, A (Netherlands)

Nucl. Phys., B
Nuclear Physics, B (Netherlands)

Nucl. Saf.
Nuclear Safety (A Bimonthly Technical Progress Review) (U.S.)

Nucl. Sci. Eng.
Nuclear Science and Engineering (U.S.)

Nucl. Sci. J. (Taiwan)
Nuclear Science Journal (Taiwan) (Ho Tsu K'o Hsueh) (China)

Nucl. Technol.
Nuclear Technology (U. S.)
Supersedes Nuclear Applications and Technology

Nuisances Environ.
Nuisances et Environnment (France)

Nukleon
Nukleon (Czechoslovakia)

Nukleonika
Nukleonika (Poland)

Nunt. Radiol.
Nuntius Radiologicus (Italy)
Ceased publication

Nuovo Cim., A
Nuovo Cimento, 11, A (Italy)

Nuovo Cim., B
Nuovo Cimento, 11, B (Italy)

Nursing Times
Nursing Times (England)

N.Y. J. Dent.
New York Journal of Dentistry, The (U.S.)

O

Obayashi-Gumi Gijutsu Kenkyusho-Ho
Obayashi-Gumi Gijutsu Kenkyusho-Ho (Report of the Engineering Research Lab., Obayashi-Gumi, Ltd.) (Japan)

Oberflaeche-Surface
Oberflaeche-Surface (Switzerland)

Obrab. Metal. Davleniem Mashinostr.
Obrabotka Metallov Davleniem v Mashinostroenii (Ukrainian S.S.R.)

Obstet. Gynecol.
Obstetrics and Gynecology (U.S.)

Obz. Mat. Fiz.
Obzornik za Matematiko in Fiziko (Yugoslavia)

Ocean Eng.
Ocean Engineering (U.S.)

Ocean Manage.
Ocean Management (Netherlands)

Oecologia (Berlin)
Oecologia (Berlin) (Continues in Part Zeitschrift fuer Morphologie und Oekologie der Tiere) (West Germany)

Oesterr. Akad. Wiss., Math.-Naturwiss. Kl., Sitzungsber., Abt. II
Oesterreichische Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse, Sitzungsberichte, Abteilung II (Austria)

Oesterr. Chem.-Z.
Oesterreichische Chemie-Zeitschrift (Austria)

Oesterr. Z. Elektrizitaetswirtsch.
Oesterreichische Zeitschrift fuer Elektrizitaetswirtschaft (Austria)

Oikos
Oikos, Acta Oecologica Scandinavica (Denmark)

Okayama Daigaku Nogakubu Gakujutsu Hokoku
Okayama Daigaku Nogakubu Gakujutsu Hokoku (Scientific Reports of the Faculty of Agriculture, Okayama University) (Japan)

Okayama Igakkai Zasshi
Okayama Igakkai Zasshi (Journal of the Okayama Medical Society) (Japan)

Oncology
Oncology (Formerly Oncologia) (Switzerland)

Onde Electr.
Onde Electrique, L (France)

Onken Kiyo
Onken Kiyo (The Bulletin of the Institute of Balneotherapeutics Kyushu University) (Japan)

Onsen Kagaku
Onsen Kagaku (Journal of the Balneological Society of Japan) (Japan)

Ont. Hydro Res. Q.
Ontario Hydro Research Quarterly (Canada)
Supersedes Ontario Hydro Research News

Ophthalmologica
Ophthalmologica. International Journal of Ophthalmology (Switzerland)

Opt. Commun.
Optics Communications (Netherlands)

Opt. Eng.
Optical Engineering (U.S.)

Optik
Optik. Zeitschrift fuer das Gesamte Gebeit der Licht-und Elektronenoptik (West Germany)

Opt.-Mekh. Prom-st.
Optiko-Mekhanicheskaya Promyshlennost (U.S.S.R.)
Issued in English translation as Sov. J. Opt. Technol.

Opto-Electronics
Opto-Electronics (England)

Opt. Spectrosc. (USSR) (Engl. Transl.)
Optics and Spectroscopy (USSR) (English Translation of Optika i Spektroskopiya) (U.S.)

Opt. Spektrosk.
Optika i Spektroskopiya (U.S.S.R.) For English Translation see Optics and Spectroscopy (USSR)

Orion
Orion (Switzerland)

Orv. Hetil.
Orvosi Hetilap (Hungary)

Osaka Kogyo Gijutsu Shikenjo Kiho
Osaka Kogyo Gijutsu Shikenjo Kiho (Bulletin of the Government Industrial Research Inst., Osaka) (Japan)

Osaka Kogyo Gijutsu Shikensho Hokoku
Osaka Kogyo Gijutsu Shikensho Hokoku (Report of the Government Industrial Research Institute, Osaka) (Japan)

Oxid. Met.
Oxidation of Metals (U. S.)

Oyo Butsuri
Oyo Butsuri (Journal of Applied Physics) (Japan)

P

Parfuem. Kosmet.
Parfuemerie und Kosmetik (West Germany)

Part. Accel.
Particle Accelerators (Scotland)

Pathol.-Biol.
Pathologie-Biologie (France)

Pathology
Pathology (Australia)

Patol. Pol.
Patologia Polska (Poland)

Pediatr. Clin. North Am.
Pediatric Clinics of North America (U.S.)

Pediat. Res.
Pediatric Research (Formerly Annales Paediatrici) (Switzerland)

Pediatrics
Pediatrics (U.S.)

Period. Polytech. Chem. Eng.
Periodica Polytechnica. Chemical Engineering. Chemische Ingenieurwesen (Hungary)

Petrol. Times
Petroleum Times, The (England)

Philips Res. Rep.
Philips Research Reports (Netherlands)

Philos. Mag.
Philosophical Magazine, The (England)

Philos. Trans. R. Soc. London, Ser. A
Philosophical Transactions of the Royal Society of London, Series A (England)

Photochem. Photobiol.
Photochemistry and Photobiology (England)

Photosynthetica
Photosynthetica (Prague) (Czechoslovakia)

Phys. Bl.
Physikalische Blaetter (West Germany)

Phys. Bull. (London)
Physics Bulletin (London) (England)

Phys. Chem. Glasses
Physics and Chemistry of Glasses (England)

Phys. Condens. Matter
Physics of Condensed Matter (West Germany)
Supersedes Phys. Kondens. Mater.

Phys. Educ.
Physics Education (England)

Phys. Fenn.
Physica Fennica (Finland)

Phys. Fluids
Physics of Fluids, The (U.S.)

Physica
Physica (Netherlands)

Physiol. Bohemoslov.
Physiologia Bohemoslovaca (Czechoslovakia)

Physiol. Zool.
Physiological Zoology (U.S.)

Phys. Lett.
Physics Letters (Netherlands) Superseded by Physics Letters, A and B (Netherlands)

Phys. Lett., A
Physics Letters, (Section) A (Netherlands)

Phys. Lett., B
Physics Letters, (Section) B (Netherlands)

Phys. Med. Biol.
Physics in Medicine and Biology (England)

Phys. News
Physics News. Bulletin of the Indian Physics Association (India)

Phys. Norv.
Physica Norvegica (Norway)

Phys. Quantum Electron.
Physics of Quantum Electronics (U.S.)

Phys. Rep.
Physics Reports. A Review Section of Physics Letters (Section C) (Netherlands)

Phys. Rev., A
Physical Review, The, A. General Physics (U. S.)

Phys. Rev., B
Physical Review, The, B. Solid State (U. S.)

Phys. Rev., C
Physical Review, The, C. Nuclear Physics (U. S.)

Phys. Rev., D
Physical Review, The, D. Particles and Fields (U. S.)

Phys. Rev. Lett.
Physical Review Letters (U.S.)

Phys. Scr.
Physica Scripta (Sweden)
Supersedes Arkiv for Fysik

Phys. Status Solidi (a)
Physica Status Solidi (a). Applied Research (East Germany)
Supersedes in part Physica Status Solidi

Phys. Status Solidi (b)
Physica Status Solidi (b). Basic Research (East Germany)
Supersedes in part Physica Status Solidi

Phys. Teach.
Physics Teacher, The (U.S.)

Phys. Technol.
Physics in Technology (England)
Supersedes Rev. Phys. Technol.

Phys. Today
Physics Today (U.S.)

Phys. Unserer Zeit
Physik in Unserer Zeit (West Germany)

Phytochemistry
Phytochemistry (England - U.S.)

Planet. Space Sci.
Planetary and Space Science (England)

Planseeber. Pulvermet.
Planseeberichte fuer Pulvermetallurgie Vereinigt mit Powder Metallurgy Bulletin (Austria)

Plant Cell Physiol. (Tokyo)
Plant and Cell Physiology (Tokyo) (Japan)

Plant Physiol.
Plant Physiology (U.S.)

Plant Soil
Plant and Soil (Netherlands)

Plasma Phys.
Plasma Physics (Formerly Journal of Nuclear Energy, Part C. Plasma Physics-Accelerators-Thermonuclear Research) (England)

Plast. Massy
Plasticheskie Massy (U.S.S.R.)
Issued in English Translation as Soviet Plastics

Plast. Reconstr. Surg.
Plastic and Reconstructive Surgery and the Transplantation Bulletin (U.S.)

Plating
Plating (U.S.)

Platinum Met. Rev.
Platinum Metals Review (England)

Pneumonologie
Pneumonologie (West Germany)
Supersedes Beitr. Klin. Erforsch. Tuberk.

Pochvozn. Agrokhim.
Pochvozanie i Agrokhimiya (Bulgaria)

Pokroky Mat., Fyz. Astron.
Pokroky Matematiky, Fiziky a Astronomie (Czechoslovakia)

Pol. Arch. Med. Wewn.
Polskie Archiwum Medycyny Wewnetrznej (Poland)

Pol. J. Pharmacol. Pharm.
Polish Journal of Pharmacology and Pharmacy (Poland)

Pol. J. Soil Sci.
Polish Journal of Soil Science (Poland)

Pollut. Atmos.
Pollution Atmospherique (France)

Pol'nohospodarstvo
Pol'nohospodarstvo (Czechoslovakia)

Pol. Przegl. Radiol. Med. Nukl.
Polski Przeglad Radiologii i Medycyny Nuklearnej (Poland)
Issued in English Translation as Polish Review of Radiology and Nuclear Medicine

Pol. Tyg. Lek.
Polski Tygodnik Lekarski (Poland)

Poluprov. Tekh. Mikroelektron.
Poluprovodnikovaya Tekhnika i Mikroelektronika (Ukrainian S.S.R.)

Polym. Eng. Sci.
Polymer Engineering and Science (U.S.)

Polymer
Polymer (England)

Polytech. Tijdschr. Procestech.
Polytechnisch Tijdschrift, Procestechniek (Netherlands)

Pomiary, Autom., Kontrola
Pomiary, Automatika, Kontrola (Poland)

Poraroqurafii
Poraroqurafii (Review of Polarography) (Japan)

Porosh. Metall., Akad. Nauk Ukr. SSR
Poroshkovaya Metallurgiya, Akademiya Nauk Ukrainskoi SSR (Ukrainian S.S.R.)
For English Translation see Soviet Powder Metallurgy and Metal Ceramics

Postepy Astron.
Postepy Astronomii (Poland)

Postepy Astronaut.
Postepy Astronautyki (Poland)

Postepy Biochem.
Postepy Biochemii (Poland)

Postepy Fiz.
Postepy Fizyki (Poland)

Postepy Fiz. Med.
Postepy Fizyki Medycznej (Poland)

Postgrad. Med.
Postgraduate Medicine (U.S.)

Postgrad. Med. J.
Postgraduate Medical Journal (England)

Potato Res.
Potato Research (Netherlands)
Supersedes Eur. Potato J.

Power Eng.
Power Engineering (U.S.)

Power (N.Y.)
Power (New York) with which are Consolidated Science and Industry, The Engineer Review, The Engineer, The Stationary Engineer, and Operating Engineer (U.S.)

Power Plant South. Afr.
Power and Plant in Southern Africa (South Africa)

Prac. Lek.
Pracovni Lekarstvi (Czechoslovakia)

Prakt. Metallogr.
Praktische Metallographie (West Germany)

Pramana
Pramana (India)

Praxis (Bern)
Praxis (Bern) (Switzerland)

Prensa Med. Mex.
Prensa Medica Mexicana (Mexico)

Prepr. Ser., Inst. Math., Univ. Oslo
Preprint Series, Institute of Mathematics, University of Oslo (Norway)

Prib. Tekh. Eksp.
Pribory i Tekhnika Eksperimenta (U.S.S.R.) For English Translation see Instruments and Experimental Techniques (USSR)

Prikl. Biokhim. Mikrobiol.
Prikladnaya Biokhimiya i Mikrobiologiya (U.S.S.R.)

Prikl. Yadern. Spektrosk.
Prikladnaya Yadernaya Spektroskopiya (U.S.S.R.)

Pr. Inst. Hutn.
Prace Instytutow Hutniczych (Poland)

Pr. Inst. Masz. Przeplyw.
Prace Instytutu Maszyn Przeplywowych (Poland)

Pr. Inst. Wlok.
Prace Instytutu Wlokiennictwa, Lodz (Poland)

Priroda
Priroda (U.S.S.R.)

Probl. Endokrinol.
Problemy Endokrinologii (Formerly Problemy Endokrinologii i Gormonoterapii) (U.S.S.R.)

Probl. Fiz. Atmos.
Problemy Fiziki Atmosfery (U.S.S.R.)

Probl. Gematol. Pereliv. Krovi
Problemy Gematologii i Pereliyaniya Krovi (U.S.S.R.)
Issued in English Translation as Problems of Hematology and Blood Transfusion (USSR)

Probl. Kosm. Fiz.
Problemy Kosmicheskoi Fiziki (Ukrainian S.S.R.)

Probl. Onkol.
Problemi na Onkologiyata (Bulgaria)

Probl. Proch. Mashinostr.
Problemy Prochnosti v Mashinostroenii (U.S.S.R.)

Probl. Prochnosti
Problemy Prochnosti (U.S.S.R.)

Probl. Tech. Med.
Problemy Techniki w Medycynie (Poland)

Probl. Tekh. Elektrodin.
Problemy Tekhnicheskoi Elektrodinamiki (U.S.S.R.)

Probl. Teor. Gravitatsii Elem. Chastits
Problemy Teorii Gravitatsii i Elementarnykh Chastits (U.S.S.R.)

Proc. Am. Power Conf.
Proceedings of the American Power Conference (U.S.)

Proc. Astron. Soc. Aust.
Proceedings of the Astronomical Society of Australia (Australia)

Proc. Camb. Philos. Soc.
Proceedings of the Cambridge Philosophical Society (England)

Process Eng.
Process Engineering Incorporating Chemical and Process Engineering (England)

Process Technol. Int.
Process Technology International (England) Absorbed by Chem. Process (London)

Proc. Fac. Sci. Tokai Univ.
Proceedings of the Faculty of Science of Tokai University (Japan)

Proc. Finn. Dent. Soc.
Proceedings of the Finnish Dental Society (Finland)

Proc. IEEE (Inst. Electr. Electron. Eng.)
Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) (Formerly Proceedings of the Institute of Radio Engineers) (U.S.)

Proc. Indian Acad. Sci., Sect. A
Proceedings of the Indian Academy of Sciences, Section A (India)

Proc. Indian Nat. Sci. Acad., Part A
Proceedings of the Indian National Science Academy, Part A. Physical Sciences (Formerly Proceedings of the National Institute of Sciences of India, Part A) (India)

Proc. Indian Nat. Sci. Acad., Part B
Proceedings of the Indian National Science Academy, Part B. Biological Sciences (Formerly Proceedings of the National Institute of Sciences of India, Part B) (India)

Proc. Inst. Civil Eng. (London)
Proceedings of the Institution of Civil Engineers (London) (England)

Proc. Inst. Electr. Eng. (London)
Proceedings of the Institution of Electrical Engineers, The (London) (England)

Proc., Inst. Teknol. Bandung
Proceedings, Institut Teknologi Bandung (Indonesia)

Proc. Iowa Acad. Sci.
Proceedings of the Iowa Academy of Science (U.S.)

Proc. Jpn. Conf. Radioisot.
Proceedings of the Japan Conference on Radioisotopes (Japan)

Proc. K. Ned. Akad. Wet., Ser. B
Koninklijke Nederlandse Akademie van Wetenschappen, Proceedings, Series B (Netherlands)

Proc. Natl. Acad. Sci. U.S.A.
Proceedings of the National Academy of Sciences of the United States of America (U.S.)

Proc. Radioisot. Soc. Philipp.
Proceedings of the Radioisotope Society of the Philippines (Philippines)

Proc. R. Irish Acad., Sect. A
Proceedings of the Royal Irish Academy, Section A (Ireland)

Proc. Roy. Soc. Queensl.
Proceedings of the Royal Society of Queensland (Australia)

Proc. R. Soc. Edinb., Sect. A
Proceedings of the Royal Society of Edinburgh, Section A. Mathematical and Physical Sciences (Scotland)

Proc. R. Soc. (London), Ser. A
Proceedings of the Royal Society (London), Series A (England)

Proc. R. Soc. Med.
Proceedings of the Royal Society of Medicine (England)

Proc. Soc. Anal. Chem.
Proceedings of the Society for Analytical Chemistry (England)

Proc. Soc. Exp. Biol. Med.
Proceedings of the Society for Experimental Biology and Medicine (U.S.)

Proc. Vib. Probl.
Proceedings of Vibration Problems (Poland)

Prof. Eng.
Professional Engineer (U.S.)

Prog. Exp. Tumor Res.
Progress in Experimental Tumor Research (Switzerland)

Prog. Hematol.
Progress in Hematology (U.S.)

Prog. Histochem. Cytochem.
Progress in Histochemistry and Cytochemistry (West Germany)

Prog. Neurol. Psychiatry
Progress in Neurology and Psychiatry (U. S.)

Prog. React. Kinet.
Progress in Reaction Kinetics (England)

Prog. Theor. Phys. (Kyoto)
Progress of Theoretical Physics (Kyoto) (Japan)

Prostaglandins
Prostaglandins (U.S.)

Prot. Met. (USSR) (Engl. Transl.)
Protection of Metals (USSR) (English Translation of Zashchita Metallov) (U.S.)

Pr. Zakresu Lesn.
Prace z Zakresu Lesnictwa (Poland)

Przegl. Wlok.
Przeglad Wlokienniczy (Poland)

Przem. Chem.
Przemysl Chemiczny (Poland)

PTB Mitt.
PTB Mitteilungen. Amts- und Mitteilungsblatt der Physikalisch-Technischen Bundesanstalt (West Germany)

Publ. Astron. Soc. Jpn.
Publications of the Astronomical Society of Japan (Japan)

Publ. Astron. Soc. Pac.
Publications of the Astronomical Society of the Pacific (U.S.)

Publ. Energ.
Publicacion sobre Energia (Argentina)

Public Util. Fortn.
Public Utilities Fortnightly (U.S.)

Publ. Museu Lab. Mineral. Geol. Univ. Coimbra Centro Estud. Geol., Mem. Not.
Publicacoes do Museu e Laboratorio Mineralogico e Geologico da Universidade de Coimbra e do Centro de Estudos Geologico, Memorias e Noticias (Portugal)

Pure Appl. Chem.
Pure and Applied Chemistry (The Official Journal of the International Union of Pure and Applied Chemistry) (England)

Pure Appl. Geophys.
Pure and Applied Geophysics (Formerly Geofisica Pura e Applicata) (Switzerland)

Q

Q. J. Mech. Appl. Math.
Quarterly Journal of Mechanics and Applied Mathematics (England)

Q. J. R. Astron. Soc.
Quarterly Journal of the Royal Astronomical Society, The (England)

Qualitas Plant. Mater. Veg.
Qualitas Plantarum et Materiae Vegetabiles (Netherlands)

R

Radex Rundsch.
Radex Rundschau (Austria)

Radiat. Bot.
Radiation Botany (England)

Radiat. Data Rep.
Radiation Data and Reports (U.S.)
Supersedes Radiological Health Data and Reports

Radiat. Eff.
Radiation Effects (England)

Radiat. Environ. Biophys.
Radiation and Environmental Biophysics (West Germany)
Continues Biophysik with Vol. 11, No. 1, 1974

Radiat. Res.
Radiation Research (U.S.)

Radiat. Res. Rev.
Radiation Research Reviews (Netherlands)

Radiats. Fiz. Nemetal. Krist.
Radiatsionnaya Fizika Nemetallicheskikh Kristallov (Ukrainian S.S.R.)

Radiats. Tekh.
Radiatsionnaya Tekhnika (U.S.S.R.)

Radiaz. Alta Energ.
Radiazioni di Alta Energia (Italy)

Radioact. Sea
Radioactivity in the Sea (Austria)

Radiobiologiya
Radiobiologiya (U.S.S.R.) Issued in English Translation as Radiobiology (USSR)

Radiobiol. Radiother.
Radiobiologie-Radiotherapie (East Germany)

Radiochem. Radioanal. Lett.
Radiochemical and Radioanalytical Letters (Switzerland - Hungary)

Radiochim. Acta
Radiochimica Acta (West Germany)

Radio Eng. Electron. Phys. (USSR) (Engl. Transl.)
Radio Engineering and Electronic Physics (USSR) (English Translation of Radiotekhnika i Elektronika) (U.S.)

Radioisotopes (Tokyo)
Radioisotopes (Tokyo) (Japan)

Radioisotopy
Radioisotopy (Czechoslovakia)

Radiol. Clin. Biol.
Radiologia Clinica et Biologica (Formerly Radiologia Clinica) (Switzerland)

Radiol. Clin. North Am.
Radiologic Clinics of North America (U. S.)

Radiol. Med.
Radiologia Medica, La (Italy)

Radiologe
Radiologe (West Germany)

Radiology
Radiology (U.S.)

Radiol. Prot. Bull.
Radiological Protection Bulletin (England)

Radioprotection
Radioprotection. Bulletin de la Societe Francaise de Radioprotection (France)

Radio Sci.
Radio Science (Formerly Journal of Research of the National Bureau of Standards, D) (U.S.)

Radiotekh. Elektron.
Radiotekhnika i Elektronika (U.S.S.R.) Issued in English Translation as Radio Engineering and Electronic Physics (USSR)

Radiotekhnika (Moscow)
Radiotekhnika (Moscow) (U.S.S.R.) Included in English translation in Telecommun. Radio Eng. (USSR)

Rast. Nauki
Rastenievʻdni Nauki (Bulgaria)

Rayonnem. Ionis. Tech. Mes. Prot.
Rayonnements Ionisants Techniques de Mesures et de Protection (France)

Razved. Geofiz.
Razvedochnaya Geofizika (U.S.S.R.)

Razved. Okhr. Nedr
Razvedka i Okhrana Nedr (U.S.S.R.)

RCA Rev.
RCA Review (U.S.)

Reakts. Sposobnost Org. Soedin., Tartu. Gos. Univ.
Reaktsionnaya Sposobnost Organicheskikh Soedinenii, Tartuskii Gosudarstvennyi Universitet (Estonian S.S.R.)
Issued in English Translation as Organic Reactivity

Recherche (Paris)
Recherche, La (Paris) (France) Supersedes Atomes (Paris) and Nucleus (Paris)

Rec. Trav. Chim.
Recueil des Travaux Chimiques des Pays-Bas (Netherlands)

Refractories (USSR) (Engl. Transl.)
Refractories (USSR) (English Translation of Ogneupory) (U.S.)

Regelungstechnik
Regelungstechnik (West Germany)

Reito
Reito (The Refrigeration) (Japan)

Rend. Ist. Lomb. Sci. Lett., A
Rendiconti dell'Istituto Lombardo di Scienze e Lettere, A Scienze Matematiche, Fisiche, Chimiche e Geologiche (Italy)

Rend. Soc. Ital. Mineral. Petrologia
Rendiconti della Societa Italiana de Mineralogia e Petrologia (Italy)

Rentgenol. Radiol.
Rentgenologiya i Radiologiya (Bulgaria)

Rep. Fac. Sci., Shizuoka Univ.
Reports of Faculty of Science, Shizuoka University (Japan)

Rep. Ionosphere Space Res. Jpn.
Report of Ionosphere and Space Research in Japan (Japan)

Rep. Math. Phys.
Reports on Mathematical Physics (Netherlands)

Rep. Prog. Phys.
Reports on Progress in Physics (England)

Rep. Prog. Polym. Phys. Jpn.
Reports on Progress in Polymer Physics in Japan (Japan)

Res. Commun. Chem. Pathol. Pharmacol.
Research Communications in Chemical Pathology and Pharmacology (U.S.)

Res./Dev.
Research/Development (U.S.)

RES, J. Reticuloendothel. Soc.
RES, Journal of the Reticuloendothelial Society (U.S.)

Rev. Asoc. Bioquim. Argent.
Revista de la Asociacion Bioquimica Argentina (Argentina)

Rev. Assoc. Med. Bras.
Revista da Associacao Medica Brasileira (Brazil)

Rev. Belge Med. Dent.
Revue Belge de Medecine Dentaire (Belgium)

Rev. Biol. Med. Nucl.
Revista de Biologia y Medicina Nuclear (Uruguay)

Rev. Bras. Fis.
Revista Brasileira de Fisica (Brazil)

Rev. Brasil. Pesquis. Med. Biol.
Revista Brasileira de Pesquisas Medicas e Biologicas (Brazil)

Rev. Bras. Tecnol.
Revista Brasilerira de Tecnologia (Brazil)

Rev. Cethedec
Revue du Cethedec (France)

Rev. Chim. (Bucharest)
Revista de Chimie (Bucharest) (Includes Chim. Anal.) (Romania)

Rev. Chim. Miner.
Revue de Chimie Minerale (France)

Rev. Clin. Esp.
Revista Clinica Espanola (Spain)

Rev. Czech. Med.
Review of Czechoslovak Medicine (Czechoslovakia)

Rev. Esp. Cardiol.
Revista Espanola de Cardiologia (Spain)

Rev. Esp. Fisiol.
Revista Espanola de Fisiologia (Spain)

Rev. Fr. Electr.
Revue Francaise de l'Electricite (France)

Rev. Fr. Energ.
Revue Francaise de l'Energie (France)

Rev. Gen. Electr.
Revue Generale de l'Electricite (France)

Rev. Gen. Therm.
Revue Generale de Thermique (France)

Rev. Geophys. Space Phys.
Reviews of Geophysics and Space Physics (U. S.)
Supersedes Reviews of Geophysics

Rev. Hosp. Clin., Fac. Med., Univ. Sao Paulo
Revista do Hospital das Clinicas, Faculdade de Medicina, Universidade de Sao Paulo (Brazil)

Rev. Int. Hautes Temp. Refract.
Revue Internationale des Hautes Temperatures et des Refractaires (Formerly Revue des Hautes Temperatures et des Refractaires) (France)

Rev. IRE
Revue IRE (Institut Naticnal des Radioelements) (Belgium)

Rev. Latinoam. Quim.
Revista Latinoamericana de Quimica (Mexico)

Rev. Metall. (Paris)
Revue de Metallurgie (Paris) (France)

Rev. Mex. Fis.
Revista Mexicana de Fisica (Mexico)

Rev. Mod. Phys.
Reviews of Modern Physics (U.S.)

Rev. Phys. Appl.
Revue de Physique Appliquee (Supplement au Journal de Physique) (France)

Rev. Port. Quim. (Lisbon)
Revista Portuguesa de Quimica (Lisbon) (Portugal)

Rev. Rhum.
Revue du Rhumatisme et des Maladies Osteo-Articulaires (France)

Rev. Roum. Chim.
Revue Roumaine de Chimie (Continuation of Revue de Chimie, Academie de la Republique Populaire Roumaine) (Romania)

Rev. Roum. Neurol.
Revue Roumaine de Neurologie (Romania)
Changed to Rev. Roum. Neurol. Psychiatr.

Rev. Roum. Phys.
Revue Roumaine de Physique (Romania)

Rev. Roum. Sci. Tech., Ser. Electrotech. Energ.
Revue Roumaine des Sciences Techniques, Serie Electrotechnique et Energetique (Romania)

Rev. Sanit. Mil.
Revista Sanitara Militara (Romania)

Rev. Sci. Instrum.
Review of Scientific Instruments, The (U.S.)

Rev. Stomatol.
Revue de Stomatologie (France)

Rev. Tech. Thomson-CSF
Revue Technique Thomson-CSF (Supersedes Annales de Radioelectricite and the Revue Technique Thomson-Houston) (France)

Rikagaku Kenkyusho Hokoku
Rikagaku Kenkyusho Hokoku (Reports of the Institute of Physical and Chemical Research) (Japan)

R.I. Med. J.
Rhode Island Medical Journal, The (U.S.)

Rinsho Hinyokika
Rinsho Hinyokika (Japan)

Rinsho Hoshasen
Rinsho Hoshasen (Japanese Journal of Clinical Radiology) (Japan)

Rinsho Kagaku
Rinsho Kagaku (Japan)

Rinsho Ketsueki
Rinsho Ketsueki (Japanese Journal of Clinical Hematology) (Japan)

Rinsho Seikei Geka
Rinsho Seikei Geka (Clinical Orthopedic Surgery) (Japan)

Riv. Agron.
Rivista di Agronomia (Italy)

Riv. Ital. Geofis.
Rivista Italiana di Geofisica (Italy)

Riv. Nuovo Cim.
Rivista del Nuovo Cimento (Italy)
Supersedes Supplemento al Nuovo Cimento

Rocky Mt. J. Math.
Rocky Mountain Journal of Mathematics, The (U.S.)

Rocky Mt. Med. J.
Rocky Mountain Medical Journal (U.S.)

Rocz. Chem.
Roczniki Chemii (Poland)

Rocz. Nauk Roln., Ser. A
Roczniki Nauk Rolniczych, Seria A (Poland)

Rocz. Panstw. Zakl. Hig.
Roczniki Panstwowego Zakladu Higieny (Poland)

Roentgen Bl.
Roentgen Blaetter (West Germany)

Roentgenpraxis
Roentgenpraxis (West Germany)

Rozpr. Elektrotech.
Rozprawy Elektrotechniczne (Poland)

Rudy (Prague)
Rudy (Prague) (Czechoslovakia)

Russ. J. Phys. Chem. (Engl. Transl.)
Russian Journal of Physical Chemistry (English Translation of Zhurnal Fizicheskoi Khimii) (England)

S

S. Afr. J. Sci.
South African Journal of Science (South Africa)

S. Afr. Mech. Eng.
South African Mechanical Engineer, The (South Africa)

S. Afr. Med. J.
South African Medical Journal (South Africa)

Sahko
Sahko. Electricity in Finland (Finland)

Saigai Igaku
Saigai Igaku (Journal of Accidental Medicine) (Japan)

SAMPE J.
SAMPE (Society of Aerospace Material and Process Engineers) Journal (U.S.)

SAMPE Q.
SAMPE Quarterly (U.S.)

Sangre
Sangre (Spain)

Sb. Geol. Ved, Rada Loziskova Geol.
Sbornik Geologickych Ved, Loziskova Geologie (Czechoslovakia)

Sb. Lek.
Sbornik Lekarsky (Czechoslovakia)

Sb. Nauch. Tr., Erevan. Politekh. Inst.
Sbornik Nauchnykh Trudov, Erevanskii Politekhnicheskii Institut (Armenian S.S.R.)

Sb. Rab., Leningrad. Vet. Inst.
Sbornik Rabot, Leningradskii Veterinarnyi Institut (U.S.S.R.)

Sb. Tr., Nauchno-Izsled. Onkol. Inst., Sofia
Sbornik Trudove, Nauchno-Izsledovatelski Onkologichen Institut, Sofia (Bulgaria)

Sb. Ved. Pr. Lek. Fak. Karlovy Univ. Hradci Kralove
Sbornik Vedeckych Praci Lekarske Fakulty Karlovy University v Hradci Kralove (Czechoslovakia)

Sb. Ved. Pr. Lek. Fak. Karlovy Univ. Hradci Kralove, Suppl.
Sbornik Vedeckych Praci Lekarske Fakulty Karlovy University v Hradci Kralove, Supplementum (Czechoslovakia)

Sb. Ved. Pr. Vys. Sk. Banske Ostrave, Rada Hutn.
Sbornik Vedeckych Praci Vysoke Skoly Banske v Ostrave, Rada Hutnicka (Czechoslovakia)

Sb. Vys. Sk. Chem.-Technol. Praze, Anorg. Chem. Technol.
Sbornik Vysoke Skoly Chemicko-Technologicke v Praze, Anorganicka Chemie a Technologie (Czechoslovakia)

Scand. J. Clin. Lab. Invest.
Scandinavian Journal of Clinical and Laboratory Investigation (Norway)

Scand. J. Gastroenterol.
Scandinavian Journal of Gastroenterology (Norway)

Scand. J. Haematol.
Scandinavian Journal of Haematology (Denmark)

Scand. J. Immunol.
Scandinavian Journal of Immunology (Norway)

Schweisstechnik (Berlin)
Schweisstechnik (Berlin) (East Germany)

Schweiz. Bauztg.
Schweizerische Bauzeitung (Switzerland)

Schweiz. Med. Wochenschr.
Schweizerische Medizinische Wochenschrift (Switzerland)

Sci. Am.
Scientific American (U.S.)

Sci. Avenir
Sciences et Avenir (France)

Sci. Cult.
Science and Culture (Calcutta) (India)

Science
Science (U.S.)

Sci. Forum
Science Forum (Canada)

Sci. Pap. Inst. Phys. Chem. Res. (Jpn.)
Scientific Papers of the Institute of Physical and Chemical Research (Japan) (Formerly Journal of the Scientific Research Institute (Japan)) (Japan)

Sci. Prog. (Oxford)
Science Progress (Oxford) (England)

Sci. Pub., Res. Inst. Radicl. Radiat. Hyg.
Scientific Publications, Research Institute of Radiology and Radiation Hygiene (Bulgaria)

Sci. Rep. (New Delhi)
Science Reporter (New Delhi) (India)

Sci. Rep. Tohoku Univ., Fifth Ser.
Science Reports of the Tohoku University, Fifth Series (Japan)

Sci. Rep. Tohoku Univ., First Ser.
Science Reports of the Tohoku University, First Series (Japan)

Sci. Rev. (Manila)
Science Review (Manila) (Philippines)

Sci. Sinica (Peking)
Scientia Sinica (Peking) (Chung Kuo Ko Hsueh) (China)
Discontinued

Sci. Sintering
Science of Sintering (Yugoslavia)
Supersedes Phys. Sintering

Sci. Sol.
Science du Sol (Supplement to Bulletin de l Association Francaise pour l'Etude du Sol) (France)

Sci. Tech. (Paris)
Sciences et Techniques (Paris) (France)

Sci. Tecnol. Alimenti
Scienza e Tecnologia degli Alimenti (Italy)

Sci. Today (Bombay)
Science Today (Bombay) (India)

Sci. Total Environ.
Science of the Total Environment (Netherlands)

Scr. Metall.
Scripta Metallurgica (U.S.)

Sdelovaci Tech.
Sdelovaci Technika (Czechoslovakia)

Search
Search. Science, Technology and Society (Australia)
Supersedes Australian Journal of Science

Sedimentology
Sedimentology (Netherlands)

Seikei Geka
Seikei Geka (Orthopedic Surgery) (Japan)

Seisan Gijutsu
Seisan Gijutsu (Production Technique) (Japan)

Sel. Annu. Rev. Anal. Sci.
Selected Annual Reviews of the Analytical Sciences (England)

Sem. Hop. Paris
Semaine des Hopitaux de Paris, La (France)

Semin. Nucl. Med.
Seminars in Nuclear Medicine (U.S.)

Sen'i Gakkaishi
Sen'i Gakkaishi (Journal of the Society of Fiber Science and Technology, Japan) (Japan)

Senpaku Gijutsu Kenkyujo Hokoku
Senpaku Gijutsu Kenkyujo Hokoku (Report of Ship Research Institute) (Japan)

Sep. Sci.
Separation Science (U.S.)

Shika Kiso Igakukai Zasshi
Shika Kiso Igakukai Zasshi (Japan)

Shimadzu Hyoron
Shimadzu Hyoron (Shimadzu Review) (Japan)

Shimizu Kensetsu Kenkyusho-Ho
Shimizu Kensetsu Kenkyusho-Ho (Reports of the Research Lab. of Shimizu Construction Co., Ltd.) (Japan)

Shinshu Igaku Zasshi
Shinshu Igaku Zasshi (The Shinshu Medical Journal) (Japan)

Shitsuryo Bunseki
Shitsuryo Bunseki (Mass Spectroscopy) (Japan)

Shu-hsueh Hsueh-pao
Shu-hsueh Hsueh-pao (Acta Mathematica Sinica) (China)

Shujutsu
Shujutsu (Operation) (Japan)

SIAM (Soc. Ind. Appl. Math.) J. Numer. Anal.
SIAM (Society for Industrial and Applied Mathematics) Journal on Numerical Analysis (U. S.)

Siemens Forsch.- Entwicklungsber.
Siemens Forschungs-und Entwicklungsberichte (West Germany)

Siemens-Z.
Siemens-Zeitschrift (West Germany)

Silikattechnik
Silikattechnik (Formerly Listed as Silikat Technik) (West Germany)

Simulation
Simulation (U.S.)

Skipsteknikk
Skipsteknikk (Norway)

Sky Telesc.
Sky and Telescope (U.S.)

Slaboproudy Obz.
Slaboproudy Obzor (Czechoslovakia)

Soc. Astron. Ital., Mem.
Societa Astronomica Italiana, Memorie (Italy)

Soc. Pet. Eng. J.
Society of Petroleum Engineers Journal, The (U.S.)

Soil Sci.
Soil Science (U.S.)

Soil Sci. Plant Nutr. (Tokyo)
Soil Science and Plant Nutrition (Tokyo) (Japan)

Soil Sci. Soc. Am., Proc.
Soil Science Society of America, Proceedings (U.S.)

Solid State Commun.
Solid State Communications (England-U.S.)

Solid-State Electron.
Solid-State Electronics. An International Journal (England)

Sol. Phys.
Solar Physics (Netherlands)

Soobshch. Akad. Nauk Gruz. SSR
Soobshcheniya Akademii Nauk Gruzinskoi SSR (Georgian S.S.R.)

Soudage Tech. Connexes
Soudage et Techniques Connexes (France)

South. Med. J.
Southern Medical Journal (U.S.)

Sov. Astron. AJ (Engl. Transl.)
Soviet Astronomy-AJ (English Translation of Astronomicheskii Zhurnal) (U.S.)

Sov. At. Energy (Engl. Transl.)
Soviet Atomic Energy (English Translation of Atomnaya Energiya) (U.S.)
Supersedes Sov. J. At. Energy

Sov. Geol.
Sovetskaya Geologiya (U.S.S.R.)

Sov. J. At. Energy (Engl. Transl.)
Soviet Journal of Atomic Energy, The (English Translation of Atomnaya Energiya) (U.S.)
Changed to Sov. At. Energy

Sov. J. Develop. Biol. (Engl. Transl.)
Soviet Journal of Developmental Biology (English Translation of Ontogenez) (U.S.)

Sov. J. Ecol. (Engl. Transl.)
Soviet Journal of Ecology (English Translation of Ekologiya) (U.S.)

Sov. J. Nondestr. Test. (Engl. Transl.)
Soviet Journal of Nondestructive Testing (English Translation of Defektoskopiya) (U. S.)

Sov. J. Opt. Technol. (Engl. Transl.)
Soviet Journal of Optical Technology (U.S.)
English Translation of Opt.-Mekh. Prom.

Sov. J. Particles Nucl. (Engl. Transl.)
Soviet Journal of Particles and Nuclei (U.S.)
English Translation of Fiz. Elem. Chastits At. Yadra

Sov. J. Quant. Electron. (Engl. Transl.)
Soviet Journal of Quantum Electronics (U.S.) English Translation of Kvantovaya Elektron. (Moscow)

Sov. Med.
Sovetskaya Meditsina (U.S.S.R.)

Sov. Phys. - Crystallogr. (Engl. Transl.)
Soviet Physics-Crystallography (English Translation of Kristallografiya) (U.S.)

Sov. Phys. - Dokl.
Soviet Physics - Doklady (English Translation of Doklady Akademiya Nauk SSSR (physics sections, except geophysics and biophysics)) (U.S.)

Sov. Phys. - Semicond. (Engl. Transl.)
Soviet Physics-Semiconductors (English Translation of Fizika i Tekhnika Poluprovodnikov) (U.S.)

Sov. Phys. - Solid State (Engl. Transl.)
Soviet Physics-Solid State (English Translation of Fizika Tverdogo Tela) (U.S.)

Sov. Phys. - Tech. Phys. (Engl. Transl.)
Soviet Physics-Technical Physics (English Translation of Zhurnal Tekhnicheskoi Fiziki) (U.S.)

Sov. Radiochem.
Soviet Radiochemistry (English Translation of Radiokhimiya) (U.S.)

Sov. Sci. Rev.
Soviet Science Review (England)

Sov. Zdravookhr. Kirg.
Sovetskoe Zdravookhranenie Kirgizii (Kirghiz S.S.R.)

Spaceflight
Spaceflight (England)

Space Life Sci.
Space Life Sciences (Netherlands)

Space Sci. Rev.
Space Science Reviews (Netherlands)

SPARMO Bull.
SPARMO Bulletin. Solid Particles and Radiation Monitoring Organization (France)

Spectrochim. Acta, Part A
Spectrochimica Acta, Part A. Molecular Spectroscopy (England)

Spectrochim. Acta, Part B
Spectrochimica Acta, Part B. Atomic Spectroscopy (England)

Spectrosc. Lett.
Spectroscopy Letters (U.S.)

Springer Tracts Mod. Phys.
Springer Tracts in Modern Physics. Ergebnisse der Exakten Naturwissenschaften (West Germany)

Srp. Arh. Celok. Lek.
Srpski Arhiv za Celokupno Lekarstvo (Yugoslavia)

Staatsbl. K. Ned.
Staatsblad van het Koninkrijk der Nederlanden (Netherlands)

Staerke
Staerke, Die (West Germany)

Stahl Eisen
Stahl und Eisen (West Germany)

Stal
Stal (U.S.S.R.)

Staub, Reinhalt. Luft
Staub-Reinhaltung der Luft (West Germany)

Sterne Weltraum
Sterne und Weltraum (West Germany)

Steroids
Steroids. An International Journal (U.S.)

Steroids Lipids Res.
Steroids and Lipids Research (Switzerland)

Stochastics
Stochastics (England)

Stomatologiya (Moscow)
Stomatologiya (Moscow) (U.S.S.R.)

Stomatologiya (Sofia)
Stomatologiya (Sofia) (Bulgaria)

Strahlenschutz Forsch. Prax.
Strahlenschutz in Forschung und Praxis (West Germany)

Strahlentherapie
Strahlentherapie (West Germany)

Strength Mater. (USSR) (Engl. Transl.)
Strength of Materials (USSR) (English Translation of Problemy Prochnosti) (U. S.)

Strojirenstvi
Strojirenstvi (Czechoslovakia)

Stroke
Stroke (U.S.)

Stud. Biophys.
Studia Biophysica (East Germany)

Stud. Cercet. Chim.
Studii si Cercetari de Chimie (Romania)

Stud. Cercet. Fiz.
Studii si Cercetari de Fizica (Formerly Academia Republicii Populare Romine, Institutul de Fizica Atomica si Institutul de Fizica, Studii si Cercetari de Fizica) (Romania)

Stud. Geophys. Geod.
Studia Geophysica et Geodaetica, Ceskoslovenska Akademie Ved (Czechoslovakia)

Stud. Soc. Sci. Torun., Sect. F
Studia Societatis Scientiarum Torunensis, Sectio F. Astronomia (Poland)

Stud. Univ. Babes-Bolyai, Ser. Chem.
Studia Universitatis Babes-Bolyai, Series Chemia (Romania)

Stud. Univ. Babes-Bolyai, Ser. Phys.
Studia Universitatis Babes-Bolyai, Series Physica (Romania)
Continues in part Studia Universitatis Babes-Bolyai, Series Mathematica-Physica

Sulzer Tech. Rev.
Sulzer Technical Review (Switzerland)

Surf. Sci.
Surface Science (Netherlands)

Surgery
Surgery (U.S.)

Surg. Forum
Surgical Forum, Proceedings of the Forum Sessions, Clinical Congress of the American College of Surgeons (U.S.)

Surg. Gynecol. Obstet.
Surgery, Gynecology and Obstetrics with International Abstracts of Surgery (U.S.)

Surv. Ophthamol.
Survey of Ophthamology (U.S.)

Suvrem. Med.
Suvremenna Meditsina (Bulgaria)

Svar. Proizv.
Svarochnoe Proizvodstvo (U.S.S.R.) Issued in English Translation as Welding Production (USSR)

T

Taisei Kensetsu Gijutsu Kenkyusho-Ho
Taisei Kensetsu Gijutsu Kenkyusho-Ho (Japan)

Talanta
Talanta (England)

Tanpakushitsu Kakusan Koso
Tanpakushitsu Kakusan Koso (Protein, Nucleic Acid, Enzyme) (Japan)

Tappi
Tappi (U.S.)

Tech. J. Ankara Nucl. Res. Cent.
Technical Journal, Ankara Nuclear Research Center (Turkey)

Tech. Mitt.
Technische Mitteilungen (West Germany)

Tech. Mod.
Technique Moderne, La (France)

Technica (Basel)
Technica (Basel) (Switzerland)

Technik (Berlin).
Technik (Berlin), Die (East Germany)

Technology (Sindri)
Technology (Sindri). Quarterly Bulletin of the Planning and Development Div., Fertilizer Corp. of India Ltd. (India)

Technol. Rev.
Technology Review (U.S.)

Technomet
Technomet (India)

Tech. Poszukiwan
Technika Poszukiwan (Poland)

Tech. Rep. Inst. At. Energy, Kyoto Univ.
Technical Reports of the Institute of Atomic Energy, Kyoto University (Japan)
Supersedes Tech. Rep. Eng. Res. Inst., Kyoto Univ.

Tech. Rev., Mitsubishi Heavy Ind.
Technical Review, Mitsubishi Heavy Industries (English Edition of Mitsubishi Juko Giho) (Japan)

Tech. Ueberwach.
Technische Ueberwachung (West Germany)

Tech.-Wiss. Abh. Osram-Ges.
Technisch-Wissenschaftliche Abhandlungen der Osram-Gesellschaft (West Germany)

Tectonophysics
Tectonophysics (Netherlands)

Tehnika (Belgrade)
Tehnika (Belgrade) (Yugoslavia)

Tekh. Kino Telev.
Tekhnika Kino i Televideniya (U.S.S.R.)

Tek. Tidskr.
Teknisk Tidskrift (Sweden)

Tek. Ukebl.
Teknisk Ukeblad (Norway)

Telecommun. J.
Telecommunication Journal (Switzerland)

Tellus
Tellus. A Quarterly Journal of Geophysics (Sweden)

Teor. Eksp. Khim.
Teoreticheskaya i Eksperimental'naya Khimiya (Ukrainian S.S.R.) Issued in English Translation as Theoretical and Experimental Chemistry (USSR)

Teor. Mat. Fiz.
Teoreticheskaya i Matematicheskaya Fizika (U.S.S.R.)

Teor. Osn. Khim. Tekhnol.
Teoreticheskie Osnovy Khimicheskoi Tekhnologii (U.S.S.R.) Issued in English translation as Theor. Found. Chem. Eng. (USSR)

Teploenergetika
Teploenergetika (U.S.S.R.)
Issued in English Translation as Thermal Engineering

Teplofiz. Teplotekh.
Teplofizika i Teplotekhnika (Ukrainian S.S.R.)

Teplofiz. Vys. Temp.
Teplofizika Vysokikh Temperatur (U.S.S.R.) Issued in English Translation as High Temperature (USSR)

Ter. Arkh.
Terapevticheskii Arkhiv (U.S.S.R.)

Teratology
Teratology (U.S.)

Termotecnica (Milan)
Termotecnica, La (Milan) (Italy)

Termotecnica (Milan), Suppl.
Termotecnica (Milan), Supplemento (Italy)

Test., Instrum. Controls
Testing, Instruments and Controls (Australia)

Tetrahedron
Tetrahedron. An International Journal of Organic Chemistry (England)

Tetrahedron Lett.
Tetrahedron Letters (England)

Tetsu To Hagane
Tetsu To Hagane (Journal of the Iron and Steel Institute) (Japan)

Tex. Law Rev.
Texas Law Review (U.S.)

Text.-Prax.
Textil-Praxis (West Germany)

Texture
Texture (England)

Theor. Appl. Genet.
Theoretical and Applied Genetics (Formerly Zuechter. Genetics and Breeding Research) (West Germany)

Theor. Chim. Acta
Theoretica Chimica Acta (West Germany)

Therapiewoche
Therapiewoche, Die (West Germany)

Therm. Eng. (USSR) (Engl. Transl.)
Thermal Engineering (USSR) (English Translation of Teploenergetika) (England - U.S.)

Thermochim. Acta
Thermochimica Acta (Netherlands)

Thin Solid Films
Thin Solid Films (Switzerland)

Thromb. Res.
Thrombosis Research (U.S.)

Tidsskr. Nor. Laegeforen.
Tidsskrift for den Norske Laegeforening (Norway)

Tien Wen Hsuen Pao
Tien Wen Hsueh Pao (Journal of Astronomy) (China)

Ti-li Chih-shih
Ti-li Chih-shih (Geographical Knowledge) (China)

Tissue Antigens
Tissue Antigens (Denmark)

Tohoku Daigaku Hisuiyoeki Kagaku Kenkyusho Hokoku
Tohoku Daigaku Hisuiyoeki Kagaku Kenkyusho Hokoku (Bulletin of the Chemical Research Inst. of Non-Aqueous Solutions, Tohoku University) (Japan)

Tohoku Daigaku Kosoku Rikigaku Kenkyusho Hokoku
Tohoku Daigaku Kosoku Rikigaku Kenkyusho Hokoku (Memoirs of the Inst. of High Speed Mechanics, Tohoku University) (Japan)

Tohoku Igaku Zasshi
Tohoku Igaku Zasshi (Tohoku Medical Journal) (Japan)

Tohoku J. Agric. Res.
Tohoku Journal of Agricultural Research, The (Japan)

Tokai Daigaku Kiyo Kogakubu
Tokai Daigaku Kiyo Kogakubu (Proceedings of the Faculty of Engineering, of Tokai University (Japan)

Tokyo Astron. Bull., Ser. II
Tokyo Astronomical Bulletin, Series II (Japan)

Tokyo Daigaku Kogakubu Kiyo, A
Tokyo Daigaku Kogakubu Kiyo, A (Journal of the Faculty of Engineering, University of Tokyo, Series A) (Japan)

Tokyo Daigaku Uchu Koku Kenkyusho Hokoku
Tokyo Daigaku Uchu Koku Kenkyusho Hokoku (Bulletin of the Institute of Space and Aeronautical Science, University of Tokyo) (Japan)

Toshiba Rebyu
Toshiba Rebyu (Toshiba Review) (Japan)

To the Point
To the Point (South Africa)

Toxicol. Environ. Chem. Rev.
Toxicological and Environmental Chemistry Reviews (England)

Toxicology
Toxicology (Netherlands)

Toyoda Kenkyu Hokoku
Toyoda Kenkyu Hokoku (Japan)

Trait. Surf.
Traitements de Surface (France)

Trait. Therm.
Traitment Thermique (France)

Trans. Am. Acad. Ophthalmol. Oto-Laryngol.
Transactions of the American Academy of Ophthalmology and Oto-Laryngology (U.S.)

Trans. Am. Nucl. Soc.
Transactions of the American Nuclear Society (U.S.)

Trans. Am. Nucl. Soc., Suppl.
Transactions of the American Nuclear Society, Supplement (U.S.)

Trans., Am. Soc. Artif. Intern. Organs.
Transactions, American Society for Artificial Internal Organs (U.S.)

Trans. Bose Res. Inst.
Transactions of the Bose Research Institute (Calcutta) (India)

Trans. Indian Ceram. Soc.
Transactions of the Indian Ceramic Society (India)

Trans. Indian Inst. Met.
Transactions of the Indian Institute of Metals (India)

Trans. Iron Steel Inst. Jpn.
Transactions of the Iron and Steel Institute of Japan (Japan)

Trans. Kans. Acad. Sci.
Transactions of the Kansas Academy of Science (U.S.)

Trans. Natl. Res. Inst. Met. (Tokyo)
Transactions of the National Research Institute for Metals (Tokyo) (Japan)

Transplantation
Transplantation (Formerly Transplantation Bulletin) (U.S.)

Transplant. Proc., Suppl.
Transplantation Proceedings, Supplement (U.S.)

Transp. Theory Stat. Phys.
Transport Theory and Statistical Physics (U.S.)

Trans. S. Afr. Inst. Electr. Eng.
Transactions of the South African Institute of Electrical Engineers (South Africa)

Trans. Soc. Adv. Electrochem. Sci. Technol.
Transactions of the Society for Advancement of Electrochemical Science and Technology (India)

Trans. Soc. Min. Eng. AIME
Transactions of the Society of Mining Engineers of AIME (U.S.)

Trans. Wis. Acad. Sci., Arts Lett.
Transactions of the Wisconsin Academy of Sciences, Arts and Letters (U.S.)

Tr. Astrofiz. Inst., Akad. Nauk Kaz. SSR
Trudy Astrofizicheskogo Instituta, Akademiya Nauk Kazakhskoi SSR (Kazakh S.S.R.)

Tr. Fiz. Inst., Akad. Nauk SSSR
Trudy Fizicheskogo Instituta Imeni P. N. Lebedeva, Akademiya Nauk SSSR (U.S.S.R.) Issued in English Translation as Proceedings (Trudy) of the P. N. Lebedev Physics Institute

Tr. Gl. Geofiz. Observ.
Trudy Glavnoi Geofizicheskoi Observatorii (U.S.S.R.)

Tr. Gor'k. Politekh. Inst.
Trudy Gor'kovskogo Politekhnicheskogo Instituta (U.S.S.R.)

Tr. Inst. Ekol. Rast. Zhivotn.
Trudy Instituta Ekologii Rastenii i Zhivotnykh (U.S.S.R.)

Tr. Inst. Ekol. Rast. Zhivotn., Ural. Nauchn. Tsentr, Akad. Nauk SSSR
Trudy Instituta Ekologii Rastenii i Zhivotnykh, Ural'skii Nauchnyi Tsentr, Akademiya Nauk SSSR (U.S.S.R.)

Tr., Inst. Eksp. Meteorol.
Trudy, Institut Eksperimental'noi Meteorologii (U.S.S.R.)

Tr. Inst. Elektrokhim., Ural. Nauchn. Tsentr. Akad. Nauk SSSR
Trudy Instituta Elektrokhimii, Ural'skii Nauchnyi Tsentr, Akademiya Nauk SSSR (U.S.S.R.)
Supersedes Tr. Inst. Elektrokhim., Akad. Nauk SSSR, Ural. Filial

Tr. Lab. Elektromagn. Polei Radiochastot Inst. Gig. Tr. Prof. Zabol. Akad. Med. Nauk SSSR
Trudy Laboratorii Elektromagnitnykh Polei Radiochastot Instituta Gigieny Truda i Professional'nykh Zabolevanii Akademii Meditsinskikh Nauk SSSR (U.S.S.R.)

Tr. Leningrad. Politekh. Inst.
Trudy Leningradskogo Politekhnicheskogo Instituta imeni M. I. Kalinina (U.S.S.R.

Tr. Metrol. Inst. SSSR
Trudy Metrologicheskikh Institutov SSSR (U.S.S.R.)

Tr. Mosk. Energ. Inst.
Trudy Moskovskogo Energeticheskogo Instituta (U.S.S.R.)

Tr. Mosk. Khim.-Tekhnol. Inst.
Trudy Moskovskogo Khimiko-Tekhnologicheskogo Instituta imeni D. I. Mendeleeva (U.S.S.R.)

Tr. Mosk. Vyssh. Tekh. Uchil.
Trudy Moskovskogo Vysshego Tekhnicheskogo Uchilishcha (U.S.S.R.)

Tr. Nauchno-Issled. Inst. Yad. Fiz., Elektron. Avtom. Tomsk. Politekh. Inst.
Trudy Nauchno-Issledovatel'skogo Instituta Yadernoi Fiziki, Elektroniki i Avtomatiki pri Tomskom Politekhnicheskom Institute (U.S.S.R.)

Tr. Nikolaev. Korablestroit. Inst.
Trudy Nikolaevskogo Korablestroitel'nogo Instituta (Ukrainian S.S.R.)

Trop. Anim. Health Prod.
Tropical Animal Health and Production (Scotland)

Tr. Radiotekh. Inst.
Trudy Radiotekhnicheskogo Instituta (U.S.S.R.)

Tr. Tadzh. Gos. Med. Inst.
Trudy Tadzhikskogo Gosudarstvennogo Meditsinskogo Instituta (Tadzhik S.S.R.)

Tr. Tomsk. Gos. Univ.
Trudy Tomskogo Gosudarstvennogo Universiteta (U.S.S.R.)iche

Tr., Tsent. Nauchno-Issled. Inst. Tekhnol. Mashinostr.
Trudy, Tsentral'nyi Nauchno-Issledovatel'skii Institut Tekhnologii i Mashinostroeniya (U.S.S.R.)

Tr. Tyumenskogo Ind. Inst.
Trudy Tyumenskogo Industrial'nogo Instituta (U.S.S.R.)

Tr. Univ. Druzhby Nar.
Trudy Universiteta Druzhby Narodov (U.S.S.R.)

Tr. Ural. Nauchno-Issled. Inst. Chern. Metal.
Trudy Ural'skogo Nauchno-Issledovatel'skogo Instituta Chernykh Metallov (U.S.S.R.)

Tr. Ural. Politekh. Inst.
Trudy Ural'skogo Politekhnicheskogo Instituta imeni S. M. Kirova (U.S.S.R.)

Tr., Vses. Nauchno-Issled. Inst. Khim. Reaktivov Osobo Chist. Khim. Veshchestv
Trudy, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Khimicheskikh Reaktivov i Osobo Chistykh Khimicheskikh Veshchestv (U.S.S.R.)

Tschermaks Mineral. Petrogr. Mitt.
Tschermaks Mineralogische und Petrographische Mitteilungen (Austria)

Tsirk. Shemakh. Astrofiz. Observ.
Tsirkulyar Shemakhinskoi Astrofizicheskoi Observatorii (Azerbadizhan S.S.R.)

Tsitol. Genet.
Tsitologiya i Genetika (Ukrainian S.S.R.)

Tsitologiya
Tsitologiya (U.S.S.R.)

Tsvetn. Met.
Tsvetnye Metally (U.S.S.R.)
For English Translation see the Soviet Journal of Non-Ferrous Metals

Tumori
Tumori (Italy)

Tungsten News
Tungsten News (U.S.)

Tung Wu Hsueh Pao
Tung Wu Hsueh Pao (Acta Zoologica Sinica) (China)

Tutkimus Tek.
Tutkimus ja Tekniikka (Finland)

Tydskr. Natuurwet.
Tydskrif vir Natuurwetenskappe (South Africa)

Tzu Tung Hua Hsueh Pao
Tzu Tung Hua Hsueh Pao (Acta Automatica Sinica) (China)

U

Uchusen Kenkyu
Uchusen Kenkyu (Studies of Cosmic Ray) (Japan)

Uch. Zap., Azerb. Inst. Nefti Khim., Ser. 9
Uchenye Zapiski, Azerbaidzhanskii Institut Nefti i Khimii, Seriya 9 (Azerbaidzhan S.S.R.)

Uch. Zap., Kabardino-Balkar. Gos. Univ.
Uchenye Zapiski, Kabardino-Balkarskii Gosudarstvennyi Universitet (U.S.S.R.)

Uch. Zap. Leningrad. Gos. Univ., Ser. Fiz. Geol. Nauk
Uchenye Zapiski Leningradskogo Gosudarstvennogo Universiteta im. A. A. Zhdanova, Seriya Fizicheskikh i Geologicheskikh Nauk (U.S.S.R.)

Uch. Zap. Leningrad. Gos. Univ., Ser. Fiz. Nauk
Uchenye Zapiski Leningradskogo Gosudarstvennogo Universiteta, Seriya Fizicheskikh Nauk (U.S.S.R.)

Uch. Zap., Mord. Gos. Univ.
Uchenye Zapiski, Mordovskii Gosudarstvennyi Universitet (U.S.S.R.)

Uch. Zap. Tartu. Gos. Univ.
Uchenye Zapiski Tartuskogo Gosudarstvennogo Universiteta (Estonian S.S.R.)

Ugeskr. Laeger
Ugeskrift for Laeger (Denmark)

Uhli
Uhli (Czechoslovakia)

Ukr. Biokhim. Zh.
Ukrainskii Biokhimichnii Zhurnal (Ukrainian S.S.R.)

Ukr. Fiz. Zh. (Russ. Ed.)
Ukrainskii Fizicheskii Zhurnal (Russian Edition) (Ukrainian S.S.R.)
Issued in English translation as Ukr. Phys. J.

Ukr. Fiz. Zh. (Ukr. Ed.)
Ukrainskii Fizichnii Zhurnal (Ukrainian Edition) (Ukrainian S.S.R.)

Ukr. Khim. Zh.
Ukrainskii Khimicheskii Zhurnal (Ukrainian S.S.R.)
Issued in English Translation as Soviet Progress in Chemistry

Umsch. Wiss. Tech.
Umschau in Wissenschaft und Technik (West Germany)
Supersedes Umschau

Umwelt
Umwelt (West Germany)

Umwelt (Inf. Bundesminist. Innern)
Umwelt (Informationen des Bundesministers des Innern zur Umweltplanung und zum Umweltschutz) (West Germany)

Umweltschutz - Staedtereinig.
Umweltschutz - Staedtereinigung (Austria)

Urania (Krakow)
Urania (Krakow) (Poland)

Urology (Ridgewood, N.J.)
Urology (Ridgewood, N.J.) (U.S.)

Usp. Fiz. Nauk
Uspekhi Fizicheskikh Nauk (U.S.S.R.)
Issued in English Translation as Soviet Physics- Uspekhi

Usp. Khim.
Uspekhi Khimii (U.S.S.R.)
Issued in English Translation as Russian Chemical Reviews

Usp. Nauch. Fotogr.
Uspekhi Nauchnoi Fotografii (U.S.S.R.)

Usp. Sovrem. Biol.
Uspekhi Sovremennoi Biologii (U.S.S.R.)

Uzb. Biol. Zh.
Uzbekskii Biologicheskii Zhurnal, Akademiya Nauk Uzbekskoi SSR (Uzbek S.S.R.)

Uzb. Geol. Zh.
Uzbekskii Geologicheskii Zhurnal (Uzbek S.S.R.)

Uzb. Khim. Zh.
Uzbekskii Khimicheskii Zhurnal, Akademiya Nauk Uzbekskoi SSR (Uzbek S.S.R.)

V

Vacuum
Vacuum. The International Journal and Abstracting Service for Vacuum Research and Technology (England)

Vaigyanik
Vaigyanik (India)

Va. Med. Mon.
Virginia Medical Monthly (U.S.)

Vannet Norden
Vannet i Norden (Norway)

VDI (Ver. Dtsch. Ing.) Ber.
VDI (Verein Deutscher Ingenieure) Berichte (West Germany)

VDI (Ver. Dtsch. Ing.) Nachr.
VDI (Verein Deutscher Ingenieure) Nachrichten (West Germany)

VDI (Ver. Dtsch. Ing.) Z.
VDI (Verein Deutscher Ingenieure) Zeitschrift fuer die Gesamte Technik (Formerly VDI (Verein Deutscher Ingenieure) Zeitschrift) (West Germany)

Veda Tech. SSSR
Veda a Technika v SSSR

Verh. Dtsch. Ges. Rheumatol.
Zeitschrift fuer Rheumatologie, Suppl. (West Germany)

Verres Refract.
Verres et Refractaires (France)

Vesmir
Vesmir (Czechoslovakia)

Vestn. Akad. Med. Nauk SSSR
Vestnik Akademii Meditsinskikh Nauk SSSR (U.S.S.R.)

Vestn. Akad. Nauk Kaz. SSR
Vestnik Akademii Nauk Kazakhskoi SSR (Kazakh S.S.R.)

Vestn. Dermatol. Venerol.
Vestnik Dermatologii i Venerologii (U.S.S.R.)

Vestn. Kiev. Politekh. Inst., Ser. Mashinostr.
Vestnik Kievskogo Politekhnicheskogo Instituta, Seriya Mashinostroeniya (Ukrainian S.S.R.)

Vestn. Leningrad. Univ., Fiz., Khim.
Vestnik Leningradskogo Universiteta, Fizika, Khimiya (Formerly Vestnik Leningradskogo Universiteta, Seriya Fiziki i Khimii) (U.S.S.R.)

Vestn. Leningrad. Univ., Geol., Geogr.
Vestnik Leningradskogo Universiteta, Geologiya, Geografiya (Formerly Vestnik Leningradskogo Universiteta, Seriya Geologii i Geografii) (U.S.S.R.)

Vestn. Leningrad. Univ., Mat., Mekh., Astron.
Vestnik Leningradskogo Universiteta, Matematika, Mekhanika, Astronomiya (Formerly Vestnik Leningradskogo Universiteta, Seriya Matematiki, Mekhaniki i Astronomii) (U.S.S.R.)

Vestn. Leningrad. Univ., Ser. Mat., Mekh. Astron.
Vestnik Leningradskogo Universiteta, Seriya Matematiki, Mekhaniki i Astronomii (U.S.S.R.)
Changed to Vestnik Leningradskogo Universiteta, Matematika Mekhanika, Astronomiya

Vestn. Mosk. Univ., Ser. III. Fiz. Astron.
Vestnik Moskovskogo Universiteta, Seriya III. Fizika, Astronomiya (U.S.S.R.)

Vestn. Mosk. Univ., Ser. II. Khim.
Vestnik Moskovskogo Universiteta, Seriya II. Khimiya (Formerly a Part of Vestnik Moskovskogo Universiteta, Seriya Matematiki, Mekhaniki, Astronomii, Fiziki i Khimii) (U.S.S.R.)

Vestn. Mosk. Univ., Ser. I, Mat., Mekh.
Vestnik Moskovskogo Universiteta, Seriya I, Matematika, Mekhanika (U.S.S.R.)

Vestn. Otorino-Laringol.
Vestnik Otorino-Laringologii (U.S.S.R.)

Vestn. Rentgenol. Radiol.
Vestnik Rentgenologii i Radiologii (U.S.S.R.)

Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk
Vestsi Akademii Navuk BSSR, Seryya Biyalagichnykh Navuk (Formerly Carried as Vestsi Akademii Navuk Belaruskai SSR, Seryya Biyalagichnykh Navuk) (Belorussian S.S.R.)

Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk
Vestsi Akademii Navuk Belaruskai SSR, Seryya Fizika-Energetychnykh Navuk (Belorussian S.S.R.)

Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk
Vestsi Akademii Navuk BSSR, Seryya Fizika- Matematychnykh Navuk (Belorussian S.S.R.)

Vestsi Akad. Navuk BSSR, Ser. Fiz.-Tekh. Navuk
Vestsi Akademii Navuk BSSR, Seryya Fizika-Tekhnichnykh Navuk (Belorussian S.S.R.)

Vestsi Akad. Navuk BSSR, Ser. Khim. Navuk
Vestsi Akademii Navuk BSSR, Seryya Khimichnykh Navuk (Belorussian S.S.R.)

Vet. Glas.
Veterinarski Glasnik (Yugoslavia)

Vet. Med. Nauki (Sofia)
Veterinarno Meditsinski Nauki (Sofia), Izvestiya na Akademiyata na Selskostopanskite Nauki (Bulgaria)

Vet. Med. (Prague)
Veterinarni Medicina (Prague) (Czechoslovakia)

Vet. Pathol.
Veterinary Pathology (Switzerland)
Continues Pathologia Veterinaria

Vet. Sb.
Veterinarna Sbirka (Bulgaria)

VGB Kraftwerkstech.
VGB Kraftwerkstechnik (West Germany)

Vide
Vide, Le, Technique-Applications (France)

Vie Milieu
Vie et Milieu (France)

Virchows Arch. Abt. B.
Virchows Archiv, B. Zellpathologie (Formerly Frankfurter Zeitschrift fuer Pathologie) (West Germany)

Virology
Virology (U.S.)

Visn. Akad. Nauk Ukr. RSR
Visnik Akademii Nauk Ukrains'koi RSR (Ukrainian S.S.R.)

Visn. Kiiv. Univ., Ser. Astron.
Visnik Kiivs'kogo Universitetu, Seriya Astronomii (Ukrainian S.S.R.)

Visn. L'viv. Derzh. Univ., Ser. Khim.
Visnik L'vivs'kogo Derzhavnogo Universitetu im. Ivana Franka, Seriya Khimichna (Ukrainian S.S.R.)

Vitis
Vitis (West Germany)

Voenno Med. Delo
Voenno Meditsinsko Delo (Bulgaria)

Voenno-Med. Zh.
Voenno-Meditsinskii Zhurnal (U.S.S.R.)

Vojen. Zdrav. Listy
Vojenske Zdravotnicke Listy (Czechoslovakia)

Vom Wasser
Vom Wasser (West Germany)

Vop. Dozim. Zashch. Izluch., Mosk. Inzh. Fiz. Inst., Sb. Statei
Voprosy Dozimetrii i Zashchity ot Izluchenii, Moskovskii Inzhenerno Fizicheskii Institut, Sbornik Statei (U.S.S.R.)

Vop. Fiz. Zashch. Reaktorov
Voprosy Fiziki Zashchity Reaktorov (U.S.S.R.)

Vop. Kurortol., Fizioter. Lech. Fiz. Kul't.
Voprosy Kurortologii, Fizioterapii i Lechebnoi Fizicheskoi Kul'tury (U.S.S.R.)

Vop. Med. Khim.
Voprosy Meditsinskoi Khimii (U.S.S.R.)

Vop. Onkol.
Voprosy Onkologii (U.S.S.R.)

Vop. Pitan.
Voprosy Pitaniya (U.S.S.R.)

Vopr. Biokhim. Nervn. Myshechnoi Sist.
Voprosy Biokhimii Nervnoi i Myshechnoi Sistem (Georgian S.S.R.)

Vop. Teor. Plazmy
Voprosy Teorii Plazmy (U.S.S.R.) Issued in English translation as Rev. Plasma Phys. (USSR)

Vop. Virusol.
Voprosy Virusologii (U.S.S.R.)

Vrach. Delo
Vrachebnoe Delo (Ukrainian S.S.R.)

Vychisl. Sist.
Vychislitel'nye Sistemy (U.S.S.R.) Issued in English Translation as Computer Elements and Systems (USSR)

Vysokomol. Soedin., Ser. A
Vysokomolekulyarnye Soedineniya, Seriya A (Continues in Part Vysokomolekulyarnye Soedineniya) (U.S.S.R.) Issued in English Translation as Polymer Science (USSR)

Vysokomol. Soedin., Ser. B
Vysokomolekulyarnye Soedineniya, Seriya B (Continues in Part Vysokomolekulyarnye Soedineniya) (U.S.S.R.)

W

Waerme- Stoffuebertrag.
Waerme- und Stoffuebertragung (West Germany)

Wasser, Luft Betr.
Wasser, Luft und Betrieb (West Germany)

Wasserwirtschaft
Wasserwirtschaft, Die (West Germany)

Water Res.
Water Research (Supersedes in Part Air and Water Pollution) (England)

Water Resour. Res.
Water Resources Research (U.S.)

Weld. J. (N.Y.)
Welding Journal, The (New York) (U.S.)

Welt (Hamburg)
Welt (Hamburg) (West Germany)

Werkstatt Betr.
Werkstatt und Betrieb (West Germany)

Werkstattstechnik
Werkstattstechnik (West Germany)

Werkst. Korros.
Werkstoffe und Korrosion (West Germany)

West. Aust. Inst. Technol. Gaz.
Western Australian Institute of Technology Gazette (Australia)

Westinghouse Eng.
Westinghouse Engineer (U.S.)

West. J. Med.
Western Journal of Medicine, The (U.S.)
Supersedes Calif. Med.

Wiad. Lek.
Wiadomosci Lekarskie (Poland)

Wien. Klin. Wochenschr.
Wiener Kliniscne Wochenschrift (Austria)

Wien. Med. Wochenschr.
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